152

McGRAW-HILL SERIES IN PSYCHOLOGY

CLIFFORD T. MORGAN

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BY DONALD M. JOHNSON

*Professor of Psychology*
*Michigan State College*

ESSENTIALS OF PSYCHOLOGY

OTHER MY MOTHER MY MOTHER MY MO

# PREFACE

This book considers integration the most important problem in textbook writing. There is some merit, no doubt, in a textbook composed of separate chapters, each complete in itself, but psychologists themselves do not think of their science in that way. Everyone who keeps up with the literature of the field knows that the topic of intelligence is not independent of the topic of thought. Personality development is not independent of learning, nor is perception independent of motivation. Experimental psychology and social psychology are not so far apart as they once were, either in method or in results. We are not doing justice to our beginning students unless they learn about these relationships, and the author assumes that the progress of psychology has made it possible to construct an integrated presentation of the field in which the relationships are apparent. Therefore, this book is not one of those which can be started at Chap. 10 as well as at Chap. 1. The order of presentation has been carefully arranged so that the early chapters set up concepts and principles needed in later chapters. To make this point clear some of the integrating themes may be listed.

Chapter 1 presents the idea of multiple causation, viewing behavior as the end result of many independent variables. The very human efforts of our students to find one-factor explanations for psychological phenomena appear to be the basis for much of the difficulty of learning psychology, so the multiplicity of behavior determinants is concretely illustrated at the outset by the penny-pitching example, and the point is reemphasized frequently in later chapters.

The chapters on motivation and emotion set up principles that are explicitly used in nearly all succeeding chapters.

The influence of motivation on perception and thought is systematically stated in the proper places, so that when the student reaches such topics as attitudes and projective tests, it is not necessary to invoke *ad hoc* explanations.

The principles laid down in the chapter on learning are used in nearly all later chapters.

Broader themes that continually recur are the dependence of behavior on biology and the socialization of the individual in the direction of the adult culture.

The nervous system and statistics, two topics which students and some instructors are tempted to evade, are not isolated in special chapters but are introduced at pertinent points where students are likely to see their importance.

Individual differences in motivation, in sensory functions, in thinking, etc., are systematically set forth at the end of each chapter after the general principles have been stated. The chapter on abilities and tests ties these topics in with the material on intelligence, mechanical abilities, and the like.

Some omissions may be noted:

Historical data are left out, and the historical approach is seldom used.

There is little discussion of different points of view within the field of psychology. An attempt is made to integrate the contributions of experimental psychology, clinical psychology, psychoanalysis, factor analysis, etc., in an eclectic but pedagogically systematic fashion.

In an introductory textbook it is neither necessary nor possible to prove every point. Certainly a wide variety of investigations should be described so that the student will learn all the important methods and get acquainted with the flavor of scientific research (and it turns out that one of the best ways to illustrate a principle is to describe the evidence on which it is based), but the details should not be allowed to distract the student from the larger principles.

As another illustration of what can be omitted if we stick to principles and their integration, consider the case of classifications. Psychologists often divide behavior or methods or people into categories A and B, or I, II, and III, then require the student to learn the distinctions between these categories. In such matters this book applies the following test: Unless the distinctions, once drawn, are used at least twice in later exposition, they can be omitted. It is a mark of the progress of a science that the textbooks become less discursive and more tightly organized.

It was hoped that a book guided by these rules would be shorter than most introductory textbooks so that the instructor can expand wherever he wishes and the students will have more time for laboratory work, classroom experiments, movies, and outside reading of some of the excellent supplementary texts now available.

After an author has decided what the student should and can get, it is his duty and his publisher's to give it to him as attractively and persuasively as possible. If textbooks had to be dull, every honest teacher and student would bow to the facts and struggle on. But they don't. Like any other science, psychology is necessarily abstract, but some illustrations and styles of writing bring the student closer to the subject matter than others. *Psychology for the Fighting Man* has shown that it is possible to brighten up a psychology book and meet the reader on his own level without departing from essentials and without disgracing the science.

Since part of the difficulty in learning psychology is due to the terminology, important technical terms are italicized when first introduced, and these are collected at the end of each chapter so as to encourage the student to give them special attention. Terms that are known to be confusing are given special clarification. A glossary of about four hundred words is appended for the same reason.

The author is grateful to his former colleagues of Gregory Hall at the University of Illinois, where most of this book was written, for their wise counsel on many of the troublesome issues. He is indebted also to many authors, editors, and publishers for permission to quote and for the use of illustrations.

DONALD M. JOHNSON

DULUTH, MINN.
*June*, 1948

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# I

# INTRODUCTION

Man is a machine, to begin with, constructed of thousands of separate parts. As in other good machines these parts work together in a smooth well-oiled fashion—most of the time at least. In order to understand man's complex activities as he goes about his business on this whirling planet, we must know a little about the parts of the body and how they are integrated.

***Behavior is integrated.*** Taking a fresh look at a man with the eye of an industrial designer or an efficiency expert, we see an intricate arrangement of 206 bones, 792 muscles, and an assortment of other highly specialized structures. Most of these structures when dissected out are damp and useless. The intact human being, however, organized of bones, muscles, glands, nerves, and blood vessels, displays an extraordinary property: *it works*. Watch it when it walks. The right foot moves forward, throwing the whole body out of equilibrium, but, at the same time, the right arm swings backward and the left arm forward, so that, in spite of what to a disinterested observer must resemble a random jerking about, the whole thing does maintain its balance, and it does get along. This pattern of activity is carried out more gracefully in some specimens than in others, to be sure, but in all healthy people the behavior of the organism is integrated in some way. Reactions of one part of the body influence reactions of other parts. Events today may produce an effect six months later, for the integration covers time as well as space.

It seems to be a mechanical necessity that when any organization becomes large and complicated—governments and businesses not excluded—a special agency develops to coordinate the parts of the organization. In the higher forms of life the chief agency of coordination is the central nervous system, though we shall see in Chap. 2 that the blood has some coordinating functions also. Every college student

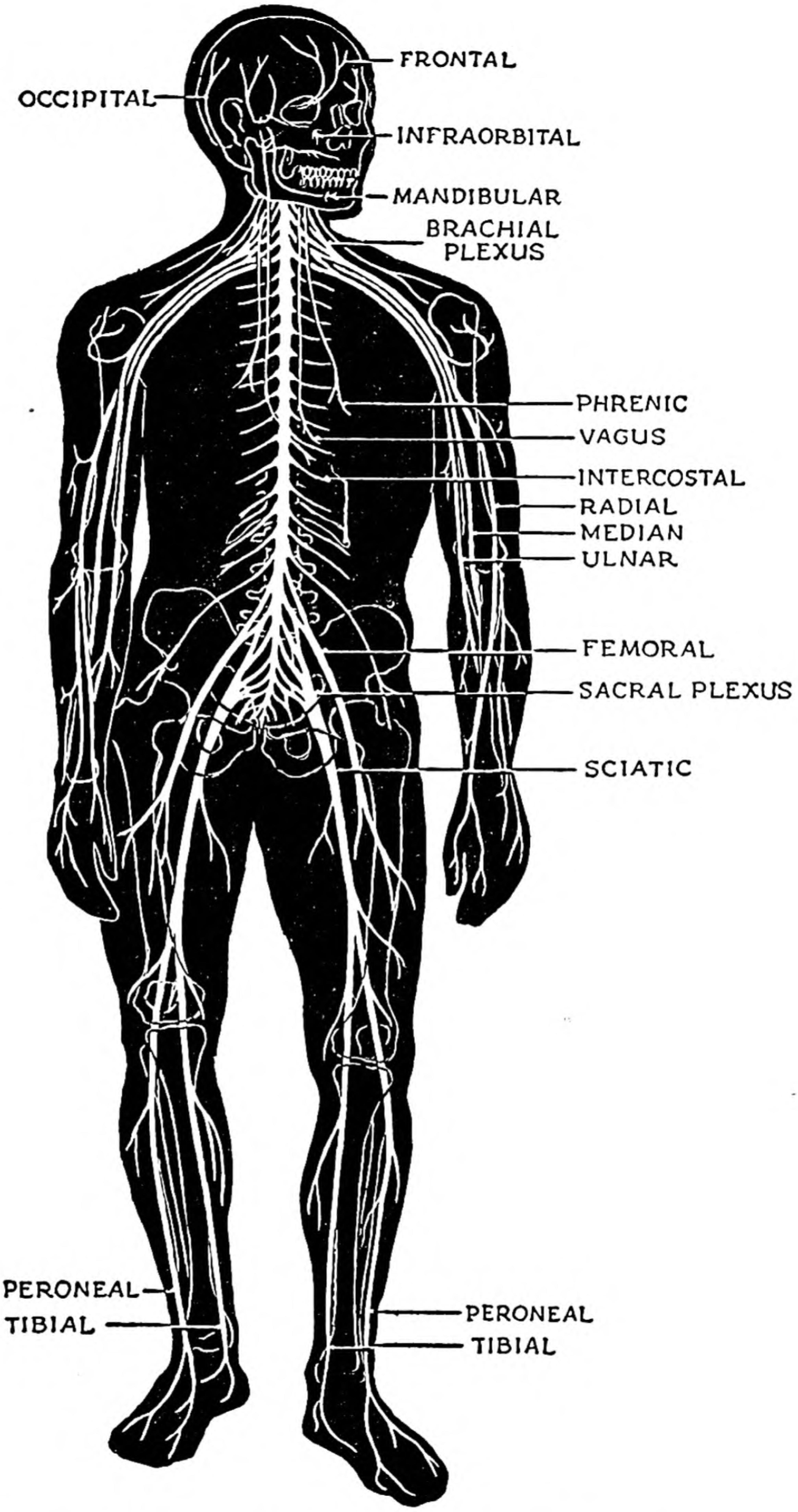

Fig. 1. General view of the central nervous system. (*From a drawing by Armin Hemberger in G. A. Baitsell, Human biology, McGraw-Hill, 1940. By permission of author and publisher.*)

knows, no doubt, that the central nervous system has been compared to an intricate telephone system, with messages going back and forth like minute electric currents, relayed from sensory nerves to spinal cord and brain, and back to muscles that carry out the orders, and that for centuries philosophers, sculptors, athletic coaches, and scientists have marveled at the smooth coordination of the human body and have speculated about the agency that accomplishes this. Today we can go much further than speculation. We know that the analogy between the nervous system and a telephone system is more than a superficial one; the nerves and muscles actually do give off small electric currents. This can be demonstrated by dissecting out a small piece of nerve and attaching electrodes to it, then running these electrodes to an amplifier. When the nerve is stimulated, small electric currents can be detected by this arrangement. Or, to avoid dissection, one can stick the electrodes on the skin over a large nerve or muscle and get electrical records for study by amplification. By fastening the electrodes to the skull with collodion the electrical activity of different parts of the brain can be investigated. The invention of the radio and the vacuum tube led to great improvements in methods of amplifying weak electric signals, opening up a whole new field of electrophysiology.

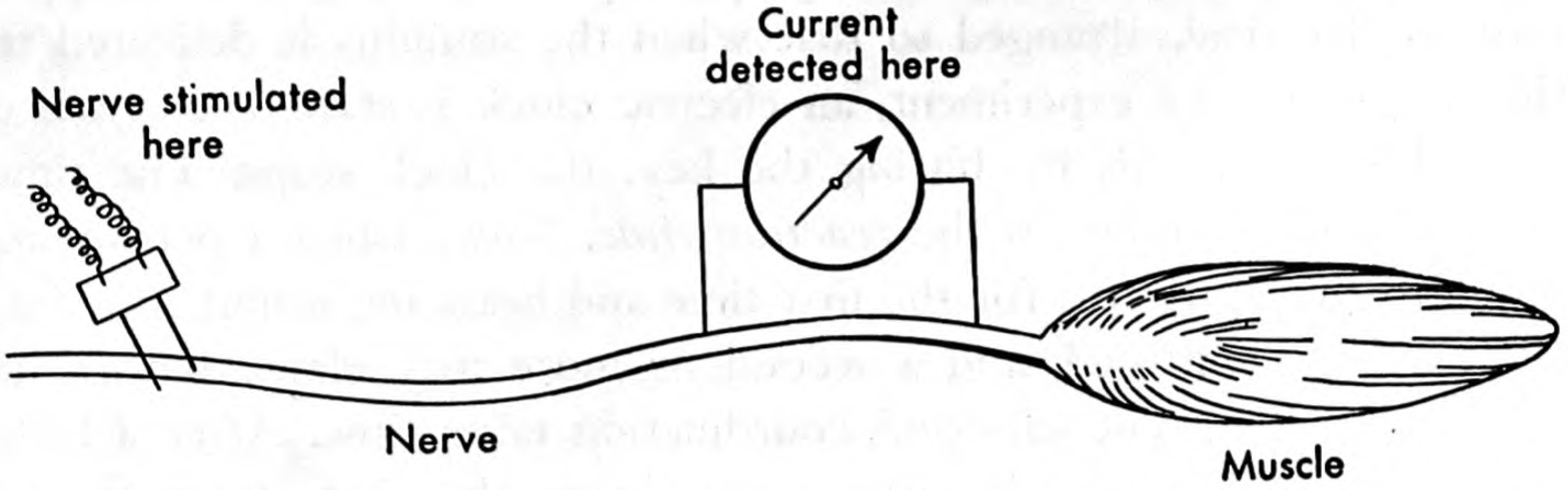

Fig. 2. Schematic drawing of nerve-muscle preparation. When the nerve is stimulated by a weak electric current at the left, a wave of electrical activity passes along the nerve toward the muscle. It can be detected by an ammeter just before the muscle contracts. Arrangements for keeping the nerve and muscle alive are not shown.

The nervous impulse travels over a nerve at a speed of about 5 miles per minute, or 430 feet per second. That is rather slow when compared with the speed of a jet-propelled plane—and it is much slower in the lower animals—but at that speed the distance from a

six-footer's head to his toe would be covered in 0.01 second. Extra time is lost at the *synapses* or junctions between one nerve and another, where there may be chemical rather than electrical communication, and in detours around the brain.

The reaction-time experiment illustrates quite clearly how the nervous system integrates the activities of sense organs and muscles. This experiment, one of the oldest in psychology, is designed to measure the time between stimulation, as by a sound of a buzzer at the ear, and reaction, as by hitting a telegraph key with a finger. The apparatus is electrical, arranged so that when the stimulus is delivered to the subject of the experiment, an electric clock is started, and when the subject responds by hitting the key, the clock stops. The time the clock was running is the *reaction time.* Now, when a person sits down to this apparatus for the first time and hears the sound stimulus, he is a little confused, and a second or more may elapse before he can hit the key. The ear-hand coordination takes time. After a little practice most respectable citizens can bring the time down to 0.2 second, because the coordination can be prepared before the stimulus is heard, after which the reaction is automatic. Or, to put it another way, at first acquaintance with a task of this kind a certain amount of brainwork is necessary in order to channel the nervous impulses from the sense organ to the correct response pathway, in this case to the muscle that moves the finger. Later this act is automatic; the integration need not be performed each time. In fact that is the way many complicated skills like swimming or playing the piano are learned. What originally required headwork and concentration becomes a smooth performance because the integration—or *set,* as the psychologists call it—is prepared in advance, and the actions are automatized.

Now let us complicate the story. We shall require our agreeable subject to make a *choice reaction.* When he hears a high-pitched sound, he is to hit a telegraph key with his right hand. When he hears a low-pitched sound, he is to hit another key with his left hand. Now his reaction time will be longer, probably around 0.4 second. Why does this reaction consume so much time? Because the integration cannot be completely prepared in advance; time for discrimination is necessary *after* each stimulus is heard. The extra time is lost in the brain where the nervous impulses are being reshuffled, eventuating finally in the pathway to one hand or the other. When

the reaction requires a difficult judgment, like choosing between two or three candidates for governor, or deciding whether Miss Atlantic City is more talented than Miss Los Angeles, reaction time may be much longer, but the coordination is accomplished in the same way.

**Behavior is variable.** Speed of activity is important in many of life's vicissitudes, and the reaction-time test has been used in a practical way, as in the selection of streetcar operators. But what is required for many of man's activities, even in this jet-propelled era, is consistency and accuracy rather than speed. If we look at this coordination of the parts of the machine from another angle, we can understand those fluctuations in behavior from one moment to the next which lead some people to claim that human conduct is unpredictable.

Take the case of a girl pitching pennies to a certain board in the floor. One set of muscles pushes her arm out, and another restrains it from going out too fast. One set of nerves keeps taut the finger muscles that hold the penny and another set lets them go at the precise moment. Many sets of muscles and nerves, together with the balancing organ in the inner ear, and other sense organs in her joints, cooperate to hold her in that half-crouching position beloved by all genuine penny pitchers. Meanwhile she is breathing, her blood is circulating, and the chemical environment of her muscles and brain is changing slightly. All these factors have their influence, great or small, on the force of the throw; they all cooperate in determining how close she comes to the board. We have here a simple act that can be taken as the prototype of all human activity, whether simple or complex. To state the case in scientific language, we can say that the final act, the pitch of the penny, technically called the *dependent variable,* is the result of many contributing factors or *independent variables.* All the activities that this book deals with—people getting married, dogs chasing cats, men and women voting, children learning to read, people hating other people, the whole subject matter of psychology—fit into this scheme, and progress in understanding human behavior consists in analyzing these relationships, finding which stimuli produce which responses, what contributing factors lead to what results.

In the penny-pitching example all the separate factors that are coordinated in the throw change a little from moment to moment.

All living tissues, muscles, nerves, glands, and sense organs, fluctuate constantly. (If you doubt it, test yourself next time you play the pinball machine. See if you can start the ball twice with the same momentum.) If all these separate factors should fluctuate in the same direction at once—a very remote possibility—the throw would be extremely long. If they should all vary in the other direction at once, the throw would be extremely short. If some fluctuate one way and some the other, which is the more common event, the throw is a medium or average throw. In our example the penny pitcher can see the results of her efforts and correct for her errors as she goes along. Therefore,

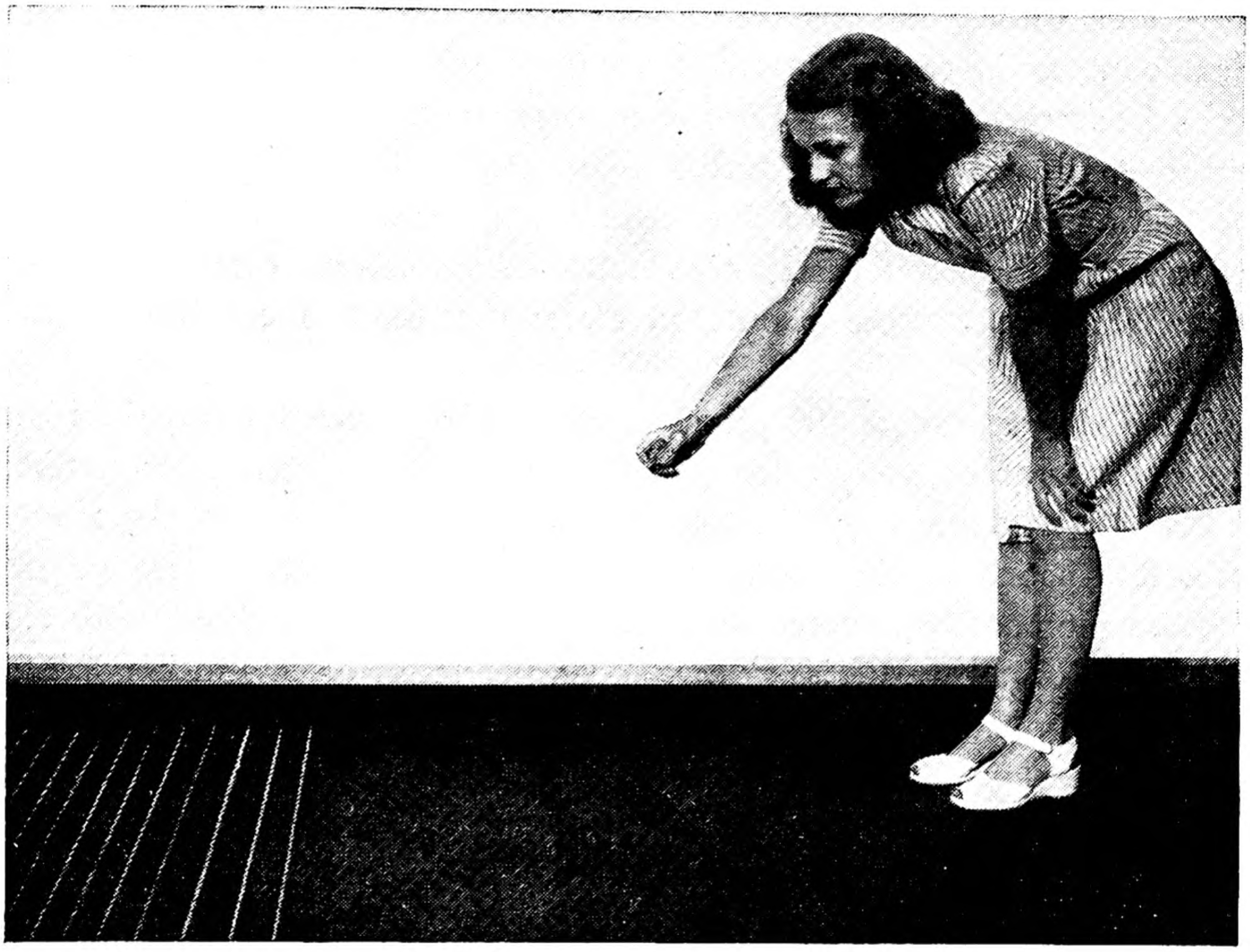

Fig. 3. This photograph of a girl pitching pennies illustrates how psychologists study behavior. The principal aspect of the behavior under investigation, the dependent variable, is the throw of the penny, which in this case can be accurately measured in inches. The throw is influenced by many conditions, such as muscle tension, stance, perception of the goal, motivation, practice, etc., which are called independent variables. The study of the relations between these two sets of variables constitutes a large part of modern psychology. (*Courtesy of Mary Kay Northan, photographer, and Carmeta McLeod, subject, University of Illinois School of Journalism.*)

her average, and most common, throw will be pretty close to the correct board, while the errors will be distributed on both sides, with the number that are too short about equal to the number that are too long.

One girl who was interested in these things pitched a penny 100 times at a board 15 feet away and landed it on the correct board 30 times. The throw was one board too short 22 times, two boards too short 9 times, three boards too short 5 times, and four boards too short twice. The too-long throws fell out about the same as those that were too short, the larger errors being less frequent than the smaller errors. All this can be seen in Fig. 4. (There will be many graphs in this book and the reader is advised to practice reading them. One truism that the psychologists have verified is the one which says that one picture is worth a thousand words.) There is a general mathematical principle, a law of probability, which describes how these variations will be distributed, and it holds for the vital activities of human beings just as it does for the size of the exploded kernels coming out of a popcorn machine. Whenever you have a dependent variable, in this case the pitch of a penny, resulting from a multitude of factors, such as muscles, nerves, and sense organs, which fluctuate

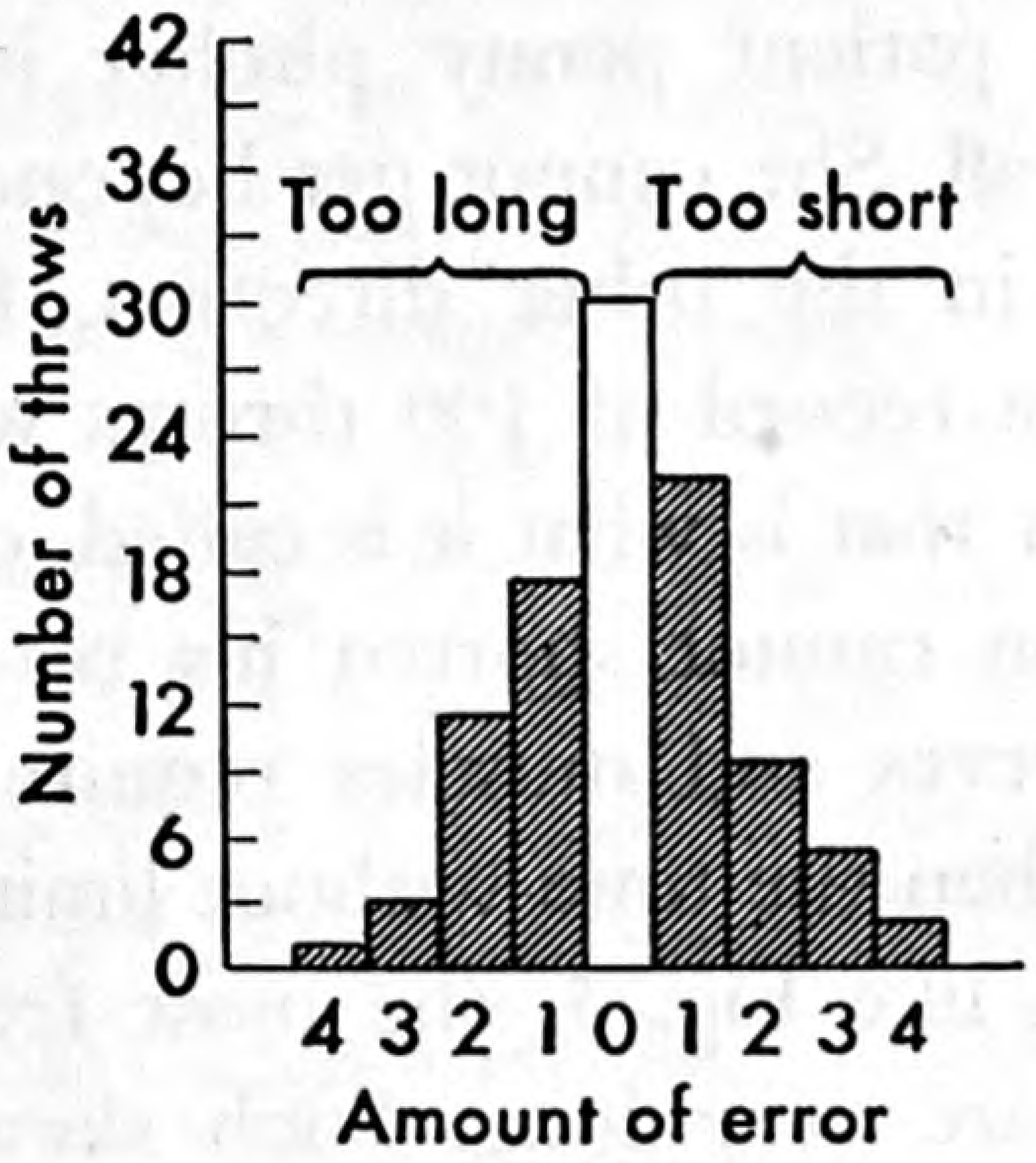

FIG. 4.

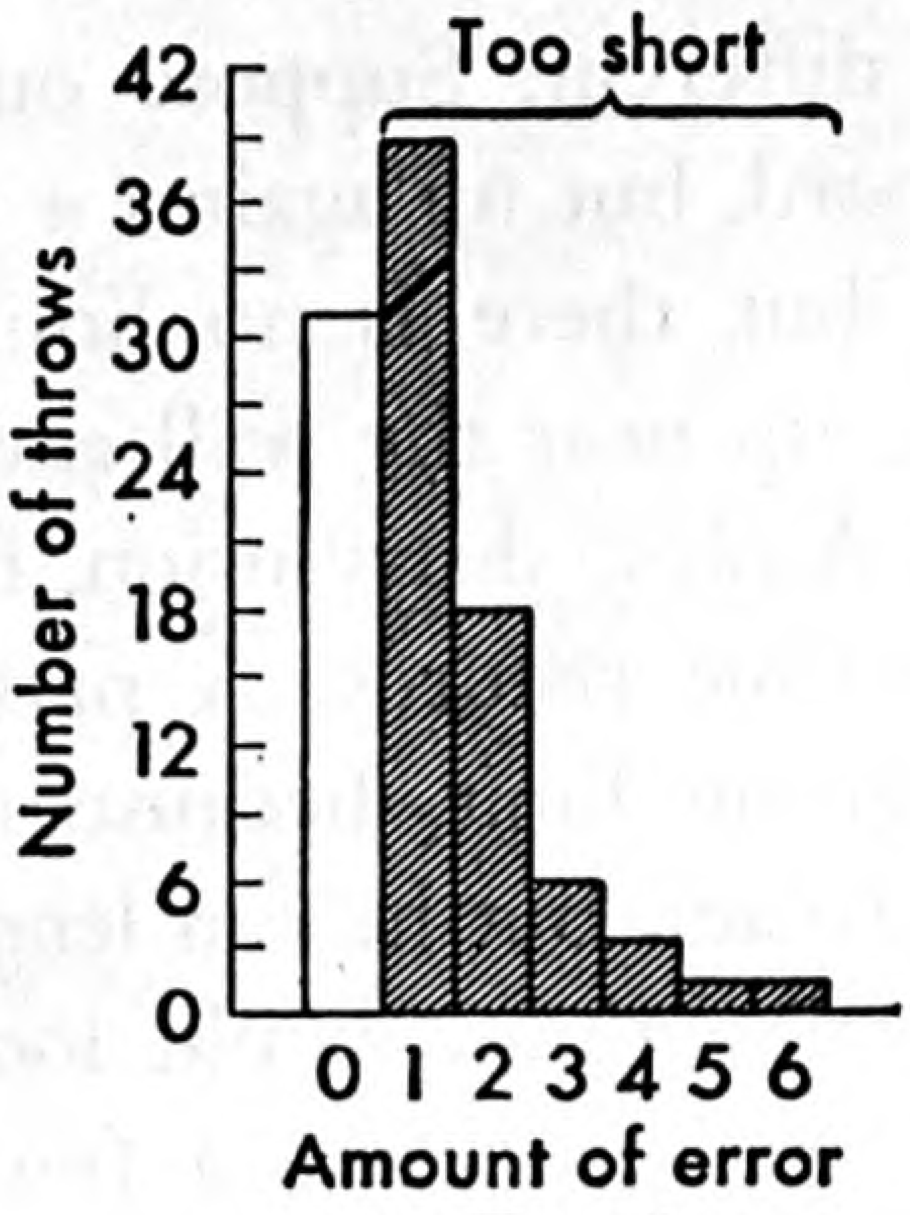

FIG. 5.

Fig. 4. Results of an experiment in pitching pennies. A girl threw a penny to a board 100 times. The throws landed on the target and on both sides of it, large errors being less frequent than small errors.

Fig. 5. Another experiment in pitching pennies. A girl threw a penny to a wall 100 times. The variation from the target, or error, in this case is all in one direction and the distribution of throws is skewed.

independently of each other, the most frequent results will be near an average value, and relatively few cases will occur at either extreme. The general picture is one of *normal distribution,* as in Fig. 4. When we take up the topics of intelligence, hearing, personality traits, and social relations, we shall find that this law of probability still holds and the graphs will look much like Fig. 4.

When there is a limit to the variation on one side or the other, the picture is different. Suppose our patient penny pitcher is pitching, not to a board, but up against a wall. She cannot get beyond the wall, of course, but there is no limit in the other direction. Hence the pitches pile up near the wall and a record of 100 throws would look like Fig. 5. A *skew* distribution, for that is what it is called, occurs also in reaction-time records. A person cannot shorten his reaction time below a certain limit, because nerves and muscles require a certain finite time to act, but he can lengthen the time without limit. A graph of 100 reaction times would look like Fig. 5, the most frequent reactions being short while a few are very long. Such skew pictures of human activities are rarer than the symmetrical ones, as in Fig. 4, but we shall see that they tell us more about the independent variables that lie behind the activities.

Thus far we have seen that human activities, even very simple sorts of activities, vary from time to time because they are the end products of a large number of factors which themselves fluctuate. Therefore human behavior is hard to predict. The more complex the behavior, the more variable it is. But when we investigate social behavior, we shall see that a curious new factor enters into the picture. Well-civilized people hold themselves up to certain standards or norms. Custom and one's own ego set limits to the variation that is permitted. People will go as close to the limit as possible but will not step over it, so it often turns out, if we observe many instances of human behavior carefully, that the picture looks more like Fig. 5 than Fig. 4. Hence we find that it is easier to predict some of the complex and significant activities of human beings, such as a man's reaction to a stop sign or to mention of higher taxes, than to predict the more trivial activities.

**Behavior is learned.** The *ability to learn,* a unique property of the nervous system, is the ability that makes possible the integration of the many separate organs of the individual into a flexible, adequate, smoothly functioning, civilized member of society. Not all coordina-

tions, to be sure, are learned. If you stick a pin in a baby, it will flinch. This is the pain *reflex*, a natural unlearned arrangement of the nervous system which is standard equipment that comes with all babies, requiring no practice. Such unlearned original equipment accounts for many of the simpler activities of life and even, especially in the lower animals, for rather complex patterns of behavior, such as nest-building and copulation. The biologists call these more complex, unlearned patterns *instincts*. In all animals, however, and especially in the higher animals, the original patterns of behavior are modified, supplemented, inhibited, or eliminated entirely, by the effects of practice. If you stick a pin in an older child, and he does not flinch but yields only a vocal response, "Please perform your absurd experiments on some other species," it is obvious that he has learned somewhere and somehow in his short life both to inhibit his natural response and to substitute for it an artificial socialized reaction. It is this effect of training or practice throughout life, modifying behavior, integrating simple reactions into complex skills, transmuting primitive tastes into civilized yearnings and taboos, which we call *learning*. This topic, perhaps the most important of all psychological topics, will have a chapter to itself and will enter into the discussion of all other topics.

**How psychology proceeds.** The science of psychology, though young, is very complicated, because the behavior of man and other animals is very complicated. The principal object of our study is man's activities, observed as carefully and objectively as possible. The best data psychology has to work with are *objective data*, records of what people do, how often, how fast, when, in what circumstances, at what age, and so on. In order to get these records the subjects, as the people or animals under observation are called, are watched, timed, photographed, and tested by many different methods.

Psychology is also interested in what people are aware of, their conscious experience or feelings under different conditions. But the only way of investigating conscious experience is to ask people how they feel or what they are aware of, and psychologists have learned, after many years of trial, that people's reports of their thoughts, feelings, and sensations are not very dependable. For this reason *subjective data*, as such reports of one's private experience are called, are not widely used in modern psychology as conclusive evidence.

Like other sciences psychology expresses the conclusions of its investigations in several ways. Often the conclusions are put into a general statement or principle, such as: Most complex performances improve with practice. Or the results may be put in the form of a table showing the number of errors during each practice period. A third method is to draw a graph of the results, with the dependent variable usually on the vertical and the independent variable on the base line. When the measurements are carefully made, the relations between dependent and independent variables can often be put into mathematical form and written as an equation. All four ways of presenting the facts and principles of psychology will be used in this book, but principally the first three.

## TECHNICAL TERMS FOR SPECIAL STUDY *

synapse
reaction time
set
choice reaction
dependent variable
independent variable
normal distribution
skew distribution
reflex
instinct
objective
subjective

## NOTES ON TERMINOLOGY

*stimulus:* any event that evokes a response. The plural is stimuli.

*effector:* the part of the body that makes a response. There are two kinds of effectors, muscles and glands.

*motor:* an adjective referring to muscular responses, *e.g.*, motor learning, motor coordination.

*organism:* any living plant or animal. The term is used to emphasize the coordination of the parts and their dependence on each other.

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* To the student: Most of the important technical terms are italicized and defined in the text. At the end of each chapter these terms are collected for convenience in studying. Test yourself, or have someone else test you on these words, and practice using them in sentences. They will be used often in later chapters. The notes on terminology attempt to clarify terms that are known to be confusing to many students.

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# 2

# THE BIOLOGY OF MOTIVES AND EMOTIONS

The chief business of psychology is to explain the complex activities of living organisms. If we take the integrated behavior of any active human being as our dependent variable and list the independent variables that influence this behavior, our list would contain hundreds of items: lights, sounds, and smells coming from objects in the environment, chemical factors in the blood, the time of day, the capacities of the organism, and so on. To study the relation of these variables, one by one, to the behavior of the organism as a whole would be a very long and uninteresting task, though it could be done. But fortunately psychology has not proceeded in such a dull pedestrian fashion. All the higher animals, including man, organize their behavior in a small number of general patterns of activity, and once these general patterns of activity are understood, many specific acts become more comprehensible. The influence of these general patterns of activity, initiating and directing the behavior of the organism, goes by the name of *motivation.* This chapter deals with biological information about motivation; the next considers motivation in a social world.

Motivation must be distinguished from energy. Energy is manufactured in the body by the combustion of food and is used up chiefly in muscular work and the radiation of heat. The well-known law of the conservation of energy, which states that the energy taken in is exactly equal to amount given off, applies to living beings just as it does to other machines. But psychology is not so much interested in transformations of energy in the body as in the behavior of

the whole organism in its daily round of activities. Energy may be stored in the body and used up slowly as the occasion requires. Or a large amount of energy may be blown up quickly in a sudden explosion of anger. Much energy is wasted when muscles work against each other and when people work under distraction. The psychology of motivation is concerned with the valves that turn the energy on and off and the motives and emotions that channel the energy in this direction or that.

## LEVEL OF ACTIVITY OR ENERGY OUTPUT

Let us begin with the obvious fact, which anyone can observe for himself, that animals and people are more active at some times than others. It is easy to measure the amount of activity of small animals that can be kept in cages. One method makes use of an activity cage of the kind shown in Fig. 6. Part of the cage is a cylinder, mounted on an axle so that it can revolve, and a counter is attached to the axle. As the rat runs in the cage, he makes it revolve, the number of revolutions being recorded by the counter. Cages have also been built on flexible supports in such a way that, when the animal moves from one side to the other, a record of his movement is obtained. Such recording devices have been attached to the beds of human subjects, making it possible for the experimenter to keep track of activity during sleep. It is much harder to get good records of the level of activity of human beings during the daytime, but estimates of work done, books read, talkativeness, restlessness, and so on, have been obtained and found useful as indications of motivation.

From laboratory experiments with such techniques and from observations of animals in their natural environment, we know that most of the higher animals exhibit a 24-hour cycle of activity. The majority of animals have their peak of activity in the daytime, but others, like the rat and the bat, are more active at night. Some basic requirement of the complex nervous system of the higher animals and man imposes a cycle of rest and restlessness on our careers, but many people with night jobs reverse the usual cycle, and one man, who lived for a month down in Mammoth Cave, Kentucky, was able to adjust to a 28-hour

cycle.[1] * Some animals, like the bears, have seasonal cycles of activity, going into a period of hibernation during the winter. These seasonal cycles are controlled by glandular activity brought on by changes in temperature and food supply. In general, the level of activity is determined by the glands, especially the thyroid gland (see page 400), by the general condition of health, and by habit. The arousal of any of the motives to be described in this chapter also increases general activity. All animals, for example, are relatively energetic when hungry; eating a good meal decreases energy output. Emotional excitement

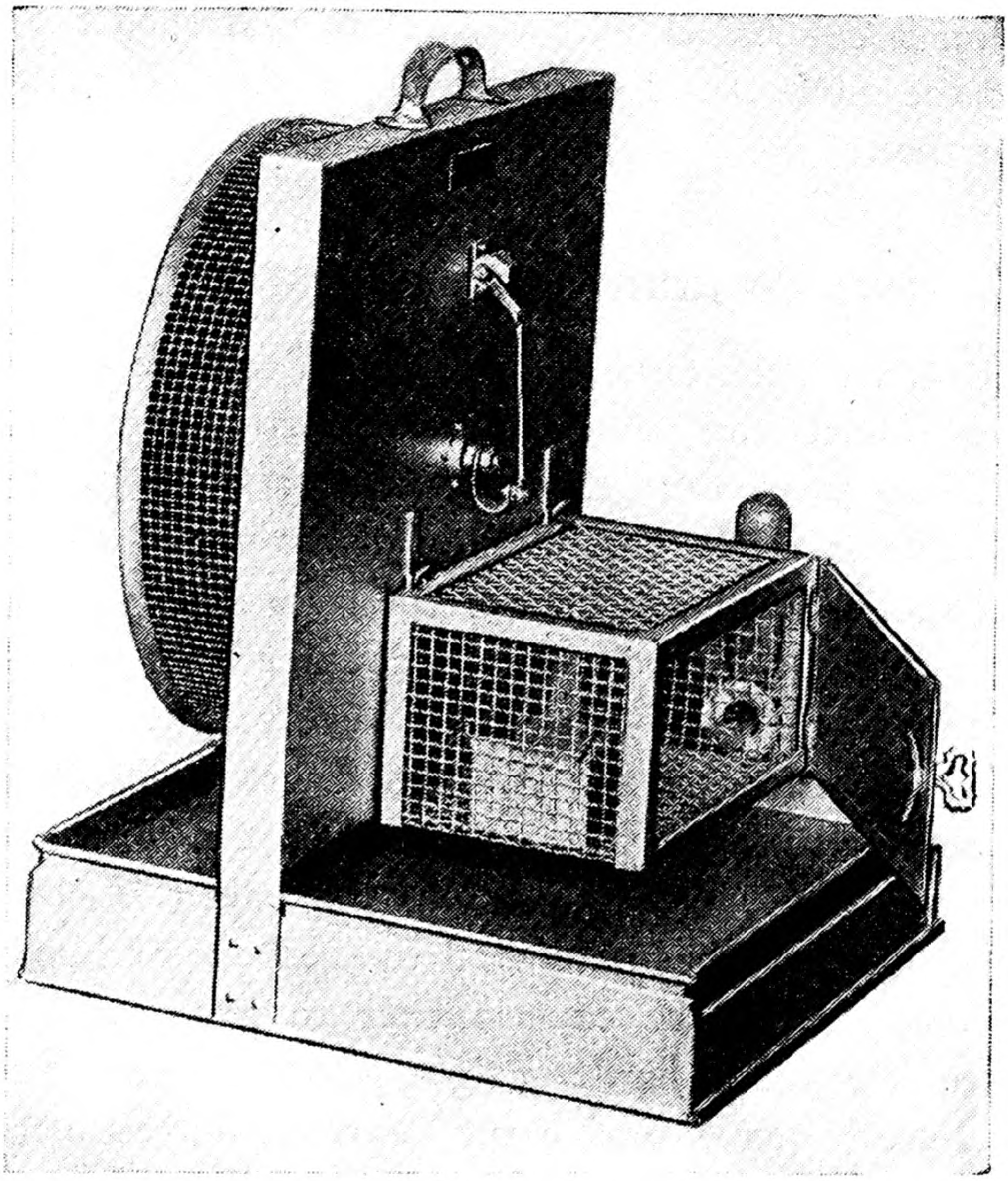

Fig. 6. Activity cage. The boxlike cage at the right is for resting, eating, sleeping, etc. It opens into the wheellike cage at the left, which is supported on an axle attached to the frame. When the animal runs, the cage revolves, and a counter on the frame records the number of revolutions in either direction. (*Courtesy Geo. H. Wahmann Mfg. Co., Baltimore.*)

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* References indicated by these numbers are arranged by chapters on pp. 443-453.

increases amount of activity, especially the excitement that is aroused by frustration and conflict. Surgical removal of both frontal lobes of the brains of rats, cats, and monkeys produces large increases in activity, especially in the simple activities like running, for one of the functions of the front part of the brain is the inhibition of random activity.[2]

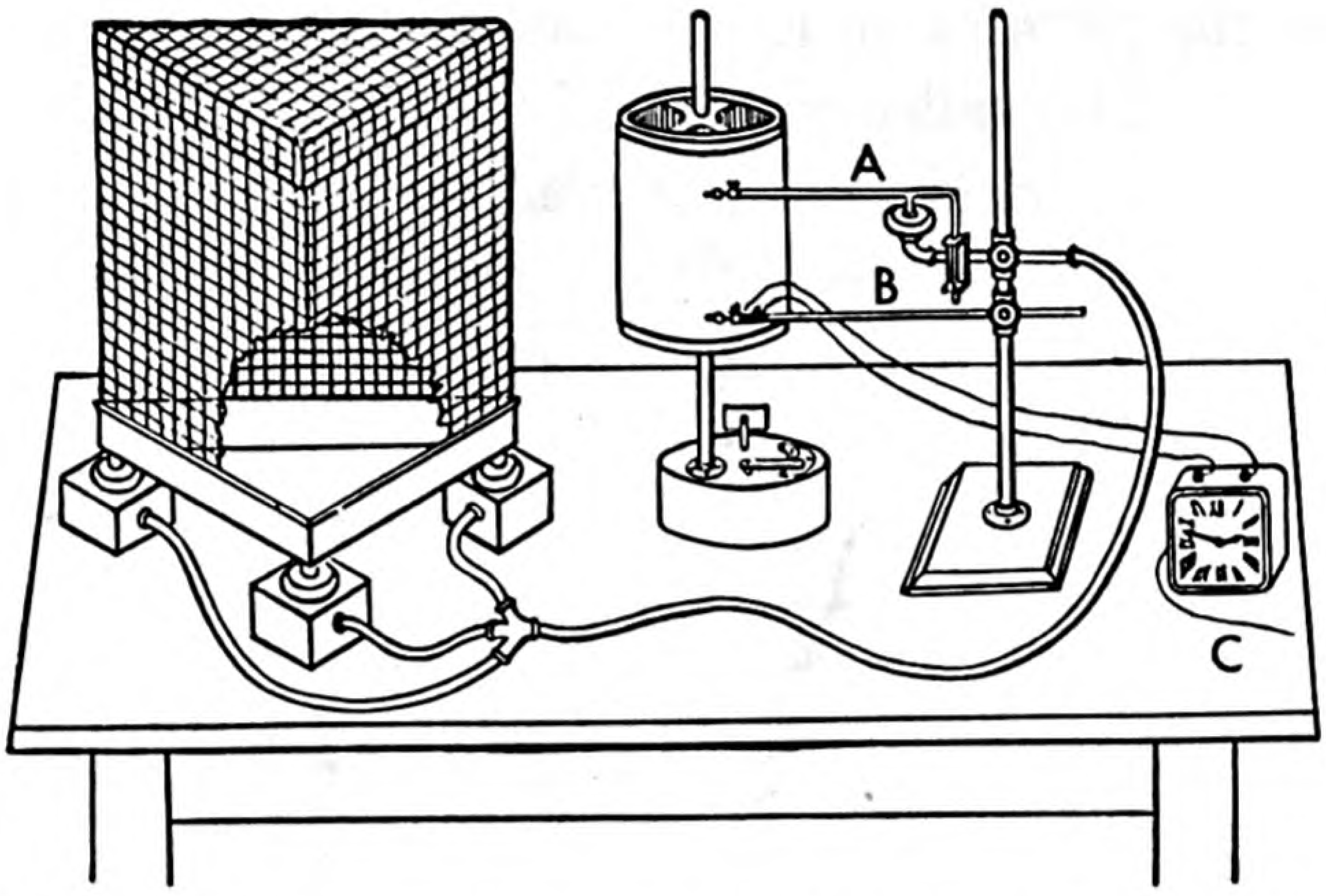


Fig. 7. Activity cage and recording apparatus. The cage is supported by the air in the rubber tubes. When the animal moves from one side to another, the pressure changes are transmitted through the tubes to the pen (*A*), which leaves a record on the revolving kymograph. The other pen (*B*) is operated by the clock (*C*), making a time mark at regular intervals for comparison. (*From C. P. Richter: 1927. Animal behavior and internal drives. Quart. Rev. Biol., 2, 307-343. By permission of the author and publishers.*)

## BIOLOGICAL MOTIVES

Amount of activity is a very broad general characteristic of life. Psychologists would like to go further and explain the specific kinds of things a person or animal does, the pattern and direction of an organism's activities. The starting point for this scientific undertaking is the fact, noted by biologists long ago, that living animals are, by and large, fairly well adapted to their environment. They manage to get food to eat and to protect themselves from danger, long enough at least that a good percentage of them reproduce their kind and preserve the species. Observing the activities of animals as they make their way about the surface of the earth, scientists have noted that they do not react automatically to all lights and sounds and smells that reach their sense organs. At times an animal is attracted to food;

at other times the same animal ignores food to go toward water, or toward an animal of the opposite sex. A large share of the activities of living animals can be seen, on careful observation, to be controlled or directed from within, in ways that help them to survive in a competitive world. When the controlling factors are chemical and neural conditions within the body, they are called *biological motives* or drives. Since the patterns of activity are similar in man and the other animals, they are also called *animal drives.*

Because biological motives like hunger, thirst, and sex are very complex, influencing life in many different ways, psychologists and biologists have studied them from several angles. First, the *overt behavior* of the organism must be observed from what he does when under the influence of the motive. Then, in the case of human subjects, psychologists are also interested in the *conscious experience* or sensation that accompanies the arousal of a motive. How does it feel to be hungry, or thirsty, or tired? (Obviously this question applies only to human beings for they are the only ones who can talk or write about their experience. The data in this case are subjective.) Finally, the *physiology of the motive, i.e.*, the chemistry of the blood, the role of the glands and the nervous system in guiding the organism's activities, must be investigated.

**Overt behavior.** The behavior of a dog that has been deprived of food for some time is easily observed. He is restless, runs around, sniffs, perhaps digs. Not only is his general activity increased, but his behavior is steered in certain directions. He is particularly responsive to certain smells. He will respond quickly to sights and sounds previously associated with food. He will nose around places where he has previously found food. Stimuli that might arouse his interest at other times, like the playful puppy next door or a comfortable bed, are now ignored. When he finds food, he eats, and his energy output decreases sharply; he licks his chops and lies down. In a few hours the cycle will be repeated. The behavior of an animal motivated by the thirst drive or the sex drive is similar. General activity is increased and more energy is released, but the activity is directed toward objects, like water or the opposite sex, that are likely to reduce the motivation.

The starting point of the biological drive is a set of chemical changes within the organism, and the end is the eating, drinking, or copulation, called the *goal response*. Between these limits the behavior is flexible

and varies considerably but is controlled by the sensitivity of the animal to promising stimuli. If the path to the goal is not clear, the behavior takes on a trial-and-error character. The animal's activity is increased. He runs here and there, does this and that, until the goal response can be made, reducing the motivation. With practice he learns the most direct path to the goal.

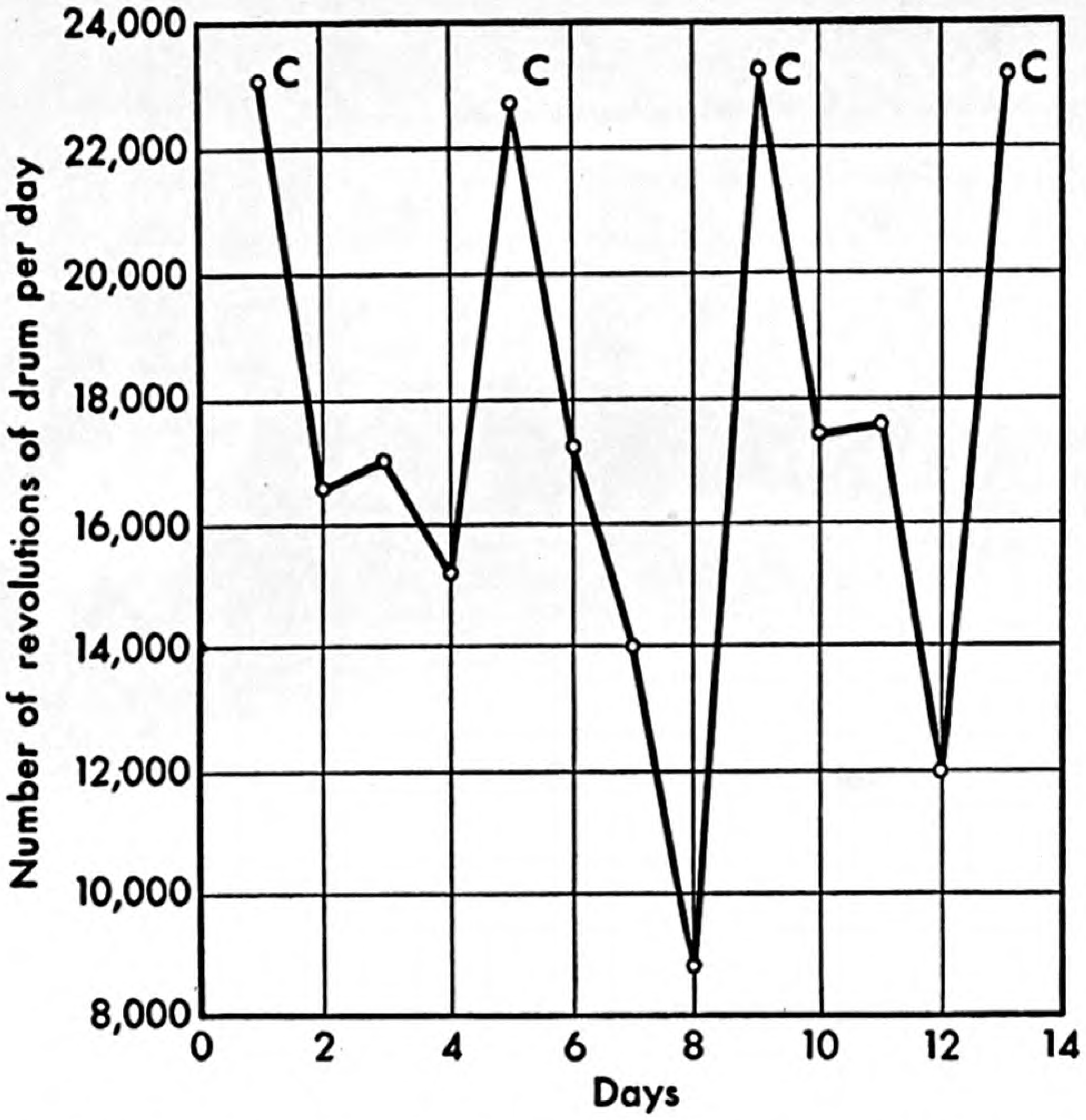


Fig. 8. Rise and fall of activity level in the female rat. Each point marked *C* represents the peak of the 4-day sexual cycle when the rat was in heat and very active. The rat's activity was measured by placing her in an activity cage similar to that shown in Fig. 6. Male rats do not show such cycles of activity. (*From G. H. Wang: 1923. Comp. Psychol. Monogr.*, 2, 27. *By permission of Williams & Wilkins, publishers.*)

There is a certain advantage in using animals for research on the biological drives. They are similar to man in these respects and much easier to handle in the laboratory. In order to measure the strength of animal drives several ingenious devices have been invented. Weight-lifting machines have been built for animals, and the size of the weight an animal will pull to get the food on the weight is taken as a measure of the strength of the motive. Rats can be trained to press a bar that lets a pellet of food run down into a trough in front of the rat's mouth as easily as children can learn to put a penny in a

gum machine. The number of times the bar is pressed in 5 minutes can then be considered an index of the strength of the hunger drive. Thirst can be measured by a gadget that automatically delivers water in the same way. Another device, called the "obstruction apparatus," works on the same general principle, namely, measuring the strength of the motive for an object in terms of how much an animal is willing to do to get it. The obstruction apparatus consists of three chambers, with the animal in one, the food or other goal object in another, and an electrified grid between. In order to get the food the animal has to cross the grid and take a shock. As soon as he gets a nibble, he is removed to the starting chamber, and he crosses again. The number

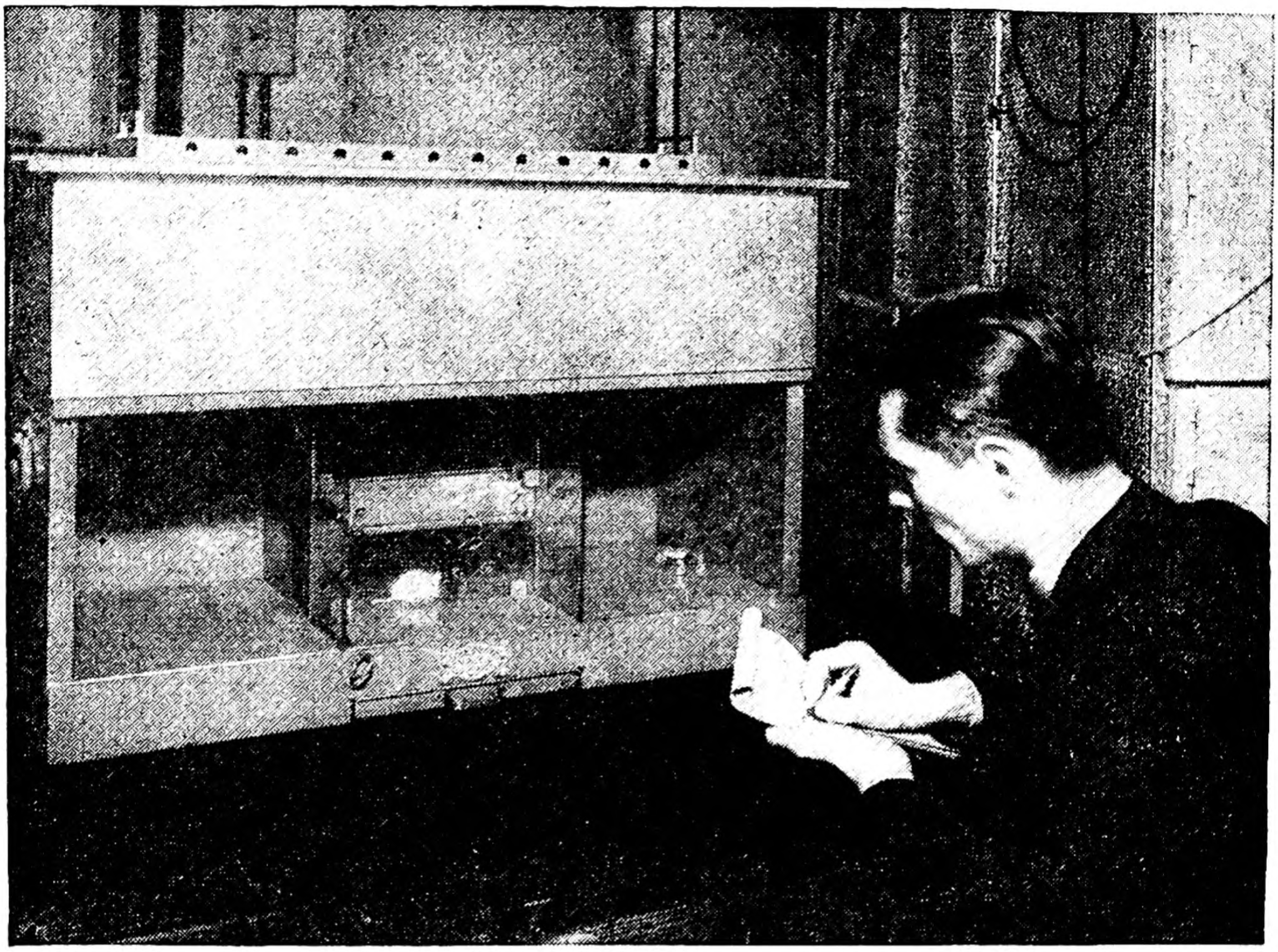


Fig. 9. Columbia obstruction box. The box has three parts, an entrance chamber on the left, a goal chamber on the right, and a passageway between the two with an electrified floor. The animal, after he becomes familiar with the box, will cross from the entrance chamber to the goal chamber, taking the shock in order to get the reward. As soon as he has a taste of the reward, he is returned to the entrance chamber. The number of times he crosses the electrified floor and takes the shock is a measure of the strength of the drive toward the goal. (*Courtesy of C. J. Warden.*)

of times he takes a shock in order to cross to the reward is an index of the strength of the drive. With this apparatus not only hunger and thirst can be measured, but also the sex and maternal drives. A male can be put on one side and a female on the other. Or a mother can be put on one side of the grid and her litter on the other. The relative strengths of several drives in the white rat when each is at its maximum are shown in the table below.[3] It is rather interesting to note how much punishment rats will take just to find out what is on the other side of the obstruction. This *exploratory drive* has been noticed in other animals also and is analogous to the well-known curiosity of human beings.

| *Drive in Operation (Others Quiescent)* | *Average Number of Crossings* |
|---|---|
| Maternal | 22.4 |
| Thirst | 20.4 |
| Hunger | 18.2 |
| Sex | 13.8 |
| Exploratory | 6.0 |

**Conscious experience.** When a hungry person is asked to describe his sensations, he will often say that he feels "empty," or that he has "hunger pangs," or that his "stomach is rumbling." A thirsty person will complain of "dryness" in the mouth and throat. Both will feel "weak." Furthermore when a person is strongly motivated by hunger, thirst, or sex, his attention will be directed toward objects that would satisfy his drive. He may dream, or daydream, about food, water, or the opposite sex. If he reports his conscious experience freely, he will speak of "desires," "wishes," "anticipations," and "yearnings." But, because of social taboos, there are times and places where sex motivation, for example, is not discussed. A person who is ashamed of sexual motivation may even succeed in repressing conscious experience of sex feelings. If some evidence of the operation of a motive can be detected though conscious experience is denied, it is called an *unconscious motive.* On the other hand, one may be conscious of a desire for food, water, or sex, but do nothing about it, for many reasons. Therefore, although overt behavior, conscious experience, and the physiological aspects of a motive go together as a general rule, we shall see in later chapters that the exceptions to this rule are very important for an understanding of human nature.

**Physiology.** The balloon technique is a highly ingenious method that was invented in order to study the activity of the stomach in hunger. This technique requires the assistance of some zealous lover of science who is willing and able to swallow a balloon with a small rubber tube attached to it. When the balloon arrives in the stomach, it can be inflated, and the rubber tube extending out of the mouth can be screwed onto an air-pressure gauge so the experimenter can record changes in the pressure exerted on the balloon by the walls of the stomach. By this device scientists have found out that when a person is asleep, he is more likely to be restless when the stomach walls are contracting than when they are quiet. A person who has gone without food will feel hunger pangs only when the stomach walls are contracting. Blood from a starving dog injected into the veins of a well-fed dog will start up the stomach contractions again.

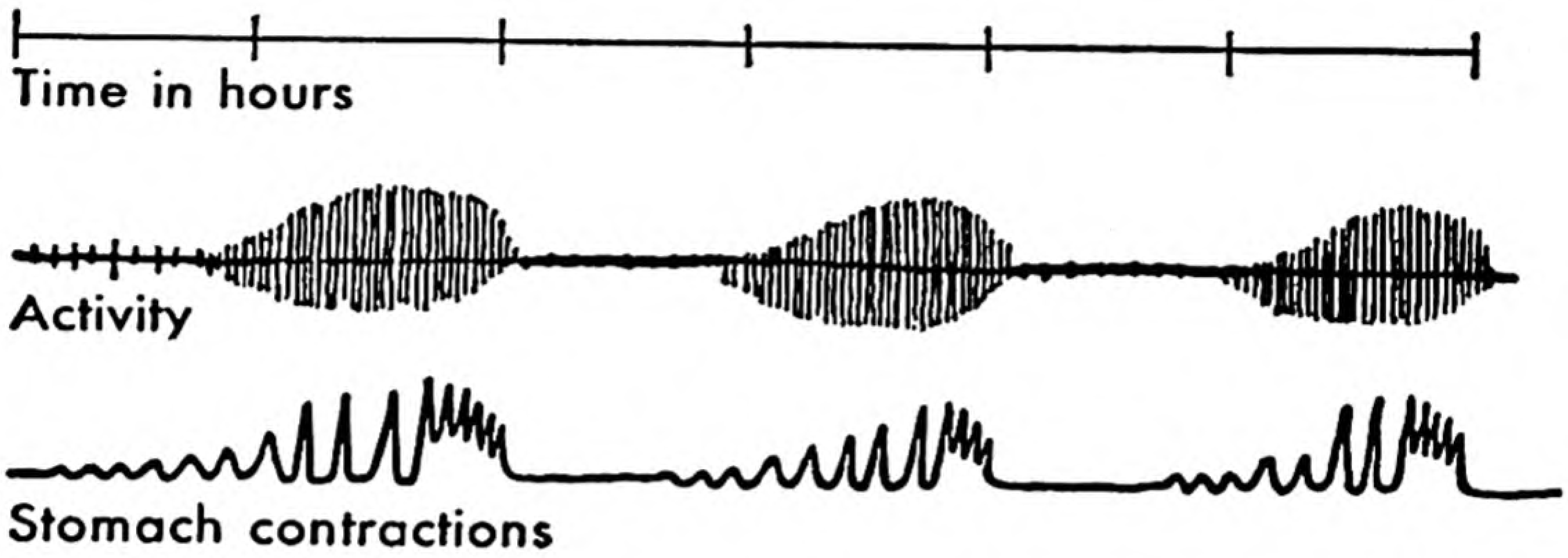


Fig. 10. Stomach contractions and general activity. Human subject swallows a balloon, which is then inflated and attached to tube-and-pen device like that in Fig. 7 for recording pressure changes. The result is a record of stomach contractions. A recording device is attached to the subject's bed for registering his activity. In general, stomach contractions and bodily activity occur about the same time. (*Redrawn from Morgan*[2] *after Wada.*)

Putting all this evidence together, with some from other experiments, we can draw up a rough picture of the hunger drive. The body uses up food, producing a change in the chemical contents of the blood. The blood flowing through the stomach leads to an increase in contractions of the stomach muscles and, flowing through certain nerve centers at the base of the brain, it prepares an integration or set of the perceptual apparatus (the sense organs and the sensory areas of the brain) to recognize and attend to food, both by smell and sight, and a set of the motor apparatus (the muscles and the motor areas of the brain) for the goal response. Conscious experience in human beings at this time is one of hunger for food, desire, and

anticipation of the goal response. Sensations from the stomach are prominent. At the same time activity is increased; hence in one way or another the animal is likely to get food. Eating the food ends this complex bodily integration. When the food is used up again by the continuous functioning of the body, the cycle starts over again.

The mechanism of thirst is quite similar, but the sensations are referred to the mouth and throat, and the cycle is shorter.

The mechanism of the sex drive is a little different in some respects since there is no deficit to be made up as in the case of food and water. The bodily integration is organized by hormones secreted into the blood stream by the sex glands, periodically in the lower animals, more or less constantly in the higher apes and man. These hormones sensitize the sense organs to certain patterns of sight, smell, and touch and prepare the genitalia for the goal response. It has been demonstrated experimentally[4] that removal of the sex glands (castration) usually eliminates the sex drive in both sexes of the lower animals. Injection of sex hormones brings the drive back up to normal. Senile rats who have lost their sex drive are not often restored to normal by vasotomy, a surgical operation some have claimed is a rejuvenator, nor by hormone therapy. The sex drive in human beings is not controlled entirely by the glands, but is modified by social custom and ego motivation.

**Self-regulatory mechanisms.** Hunger, thirst, and sex are the most important biological drives for psychology, since they may be in operation for long periods of time and may account for a large share of animal and human activity. The activities of the body are integrated by several other mechanisms, called *self-regulatory mechanisms*, by which the internal environment of the body is maintained in good working condition. When the temperature of the body falls, for example, we start to shiver, get restless, and may move to a warm place. We feel cold. When the temperature rises, we lose heat by perspiration, we feel less energetic and burn up less food. There is a nerve center in the brain that, like a thermostat, controls the production of heat in the body and bodily activities that raise and lower temperature. Rate of breathing is controlled in the same way. These mechanisms operate automatically, according to bodily need, and usually do not have any great effect on behavior. But anyone who doubts the tremendous motivating power of the breathing mechanism needs

only to hold his head under water for a half minute. Inability to breathe quickly causes struggling and a vivid sensation of suffocation.

**Specific hungers.** Although the hunger for food in general is a dependable motive as the basis of much human and animal activity, the body needs many specific foods and is able to discriminate among the offerings of nature and the laboratory according to these needs. Rats, for example, that have been deprived of sugar will quickly learn to discriminate sugar from other foods and will eat large amounts until the deficiency has been made up. Specific hungers for sugar, salt, thiamin, riboflavin, phosphorus, sodium, and calcium have been demonstrated in rats. The needs for oxygen and for water might also be called specific hungers, and there are probably others. One experiment on human beings showed that newly weaned infants will make reasonably good choices of food, if given the opportunity, though they may go on "spinach jags" or "sugar jags" for short times. Usually, of course, children are not given the opportunity to follow their

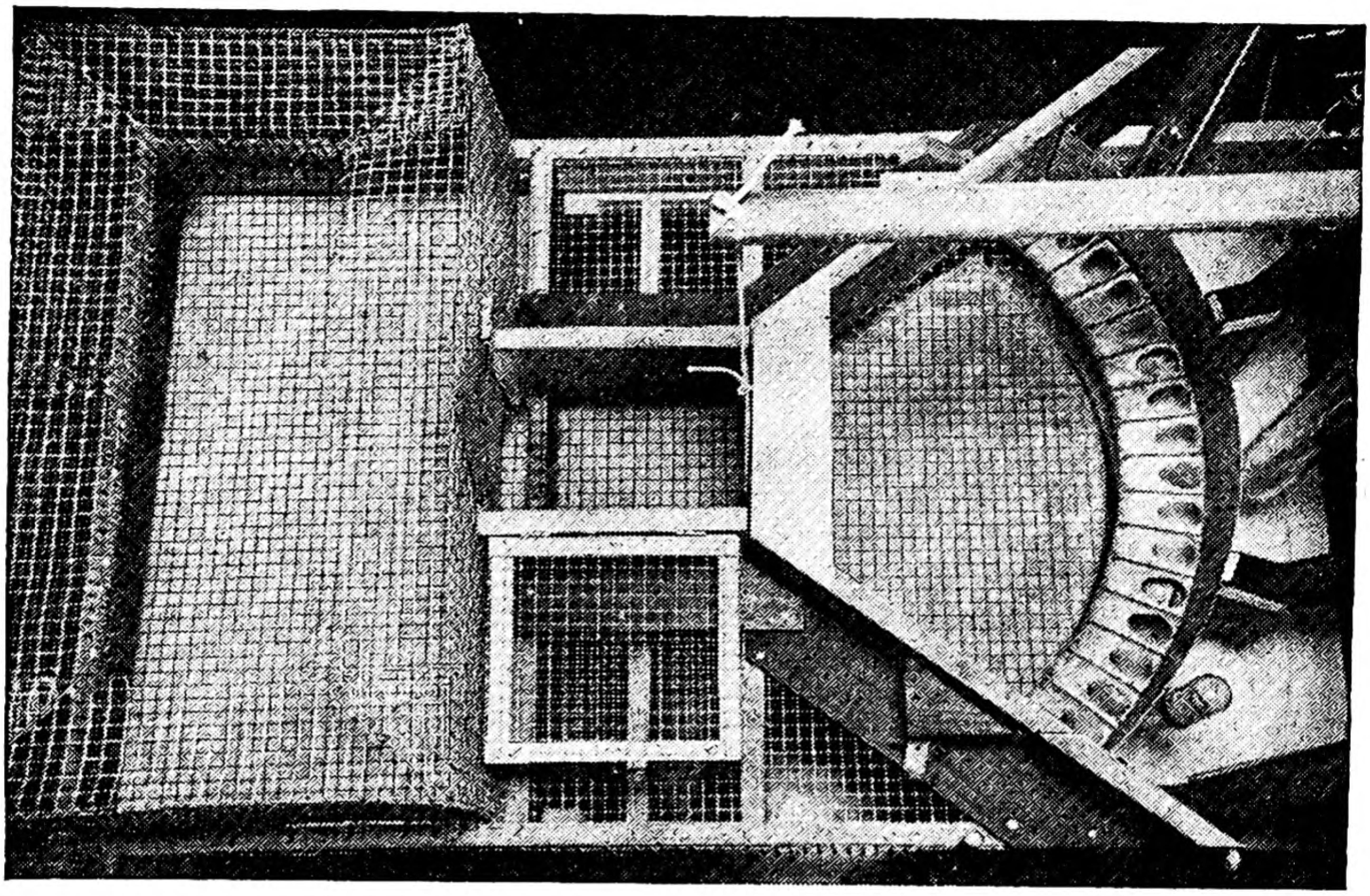


Fig. 11. Top view of rat cafeteria for testing food preferences. The foods in powdered form are in the egg-shaped receptacles arranged in an arc at the right. The rat enters from the left through the gate in the middle and makes his selection where he can be observed by the experimenter. (*Courtesy of P. T. Young.*)

natural tastes; their preferences are molded by family preferences, fads, and taboos. Though the operation of specific hungers is amply proved, we need not jump to the conclusion that all food necessities can be recognized as such. Rats deprived of vitamins A and D, for example, do not show any special preference for foods containing these elements.[5]

## BIOLOGICAL AND SOCIAL SIGNIFICANCE OF MOTIVES

It is easy to see the biological utility of these motives. All these activities, *i.e.*, getting food and water, maintaining a constant temperature and favorable chemical conditions inside the body, and so on, are very complex activities. If they were left to chance or to individual experimentation, the organism would be dead before the right coordination could be developed. Therefore these drives are said to have *survival value* for the organism. The sex drive is a little different. It does not supply any requirement for the individual; in fact copulation does the animal no good at all. But sex is necessary for the survival of the species. If the animals that reproduce sexually did not, during the course of evolution, develop some mechanism like the sex drive, for guaranteeing that the sexes would be attracted to each other, the species simply would not survive.

All the biological drives are inherited. They are standard equipment that comes with the animal. But as the animal lives and grows, he may modify his ways of hunting food and water. The copulation pattern in experienced rats is a little different from that in novices. The sex drive may be modified greatly, or entirely repressed. The conscious experiences of sex are especially susceptible to repression. Domesticated animals learn to fit into human habits. Human beings get used to eating 3 times a day, or 2, or 4. In fact a large share of what people learn, they learn in the process of satisfying their biological drives, as we shall see later in the chapter on learning.

Psychologists study the biological drives because they help to explain the activities of living organisms. After studying these drives, we see that the physiological changes in the body integrate the organism's activities so that overt behavior and conscious experience follow certain rather definite patterns. In the case of wild animals, and precivilized man, a large share of the day is accounted for by the bio-

logical drives, by the pursuit of food, water, and the opposite sex, by keeping warm and comfortable. It is correct to say, therefore, that knowledge of the biological drives helps to explain much of animal life.

The fact that people are animals with the same biological drives as most of the other animals accounts for the existence of farms, restaurants, drinking fountains, delivery systems, furnaces, electric fans, oxygen tanks, and salt shakers. A very large segment of modern business organization is given over to satisfying the biological motives of the people. In the civilized way of life the forethought of human beings and the economic division of labor meet biological needs, with the exception of sex, quite regularly, leaving time and effort free for the operation of other motives, to be described soon, *i.e.*, the social motives. So, ordinarily, hunger and thirst are not strongly aroused but during warfare, economic depressions, floods, and other catastrophes, when civilization breaks down, animal drives reassert their dominance.

## THE BASIC EMOTIONS

Emotions, like motives, organize behavior in certain general patterns, but the biological motives originate in internal bodily rhythms, while the emotions are touched off by environmental events. A motive integrates the organism's behavior, in a more or less flexible way and perhaps over a long period of time, toward a goal object. An emotion stirs up a sudden outburst of rather stereotyped activity in reaction to a prominent stimulus object; when the stimulus object is removed, the emotion usually subsides. Biological motives are cyclical; emotions are episodic. The distinction is not clear-cut because motive and emotion are terms taken over by psychology from the popular language. Like the biological motives, emotions have been investigated from three angles: overt behavior, conscious experience, and the physiology of emotion.

**Overt behavior.** When a person is severely frightened, he is likely to yell and run away. One who is angry may cry or curse and start to fight. Analogous behavior may be observed in the lower animals in the form of avoidance reactions and defense mechanisms. Dogs growl and bare their teeth. Cats spit and arch their backs. Bees sting. Some snakes rattle and strike. Pleasant emotions in human beings usually are accompanied by smiling or laughter and perhaps running to-

ward the object that aroused the emotion. It is in these respects that emotions resemble motives, for they raise the level of activity and steer the activity in certain general directions.

One manifestation of emotion, *i.e.*, facial expression, has been studied rather carefully by psychologists for many years. Usually a person's facial muscles are tense when he is emotionally excited; then, as the emotion subsides, his face relaxes. The rise and fall of facial tension coincide with the rise and fall of the general level of bodily activity. Aside from this general tenseness, emotions are not accurately registered in the face. When psychologists have aroused emotion in infants by delaying feeding, by sticking needles in them, by dropping them, restraining their movements, and so on, and then asked observers to identify the specific emotions expressed, the observers' accuracy has been quite low.[6] When the same experiment is done with adults, accuracy of identification is much higher. Adults have learned the conventional ways of using their facial muscles to communicate their

Fig. 12. Facial expression of a young baby. Can you name this expression? Answer at end of chapter. (*Courtesy of Alice Ann Walker, University of Illinois School of Journalism.*)

feelings to others, so, if the observers know the language, the communication is fairly accurate.[7] There are only a few genuine emotional expressions, such as smiling, laughing, crying, and tension. Other facial expressions are social expressions, a kind of language, which will be discussed more fully in the section on communication (page 253).

Fig. 13. Facial expression in adults. This is a news photograph taken on a street in Marseilles when the German army entered the city and French flags were hauled down. (*Press Association.*)

**Conscious experience.** No one who has lived very long in a world given to total war and a high accident rate needs to have the emotional experience described to him. As a matter of fact psychologists have little to say about the subjective side of emotions which the novelists and the poets have not said better. In describing this "stirred-up state," about all one can do is to invent metaphors. Writers use phrases like "a sinking feeling in the pit of the stomach," "butterflies in the stomach," "feeling tense" (which is literally accurate), "my heart stood still" (which is absurd), and "my mind went blank." The blank-

ness of the mind under strong emotion refers to a genuine phenomenon, because many reports of silly mistakes during emotional excitement have been authenticated, and actual experiments have demonstrated a reduction in ability to master difficult tasks under emotional stress.

During the recent war one pilot, who had been a psychology student at Brown University, kept careful records of his emotional experiences. From these records he drew Fig. 14 and wrote the following account.[8] (The numbers in parentheses refer to the military time system: 0430 means 4:30 A.M.; 1920 means 7:20 P.M.)

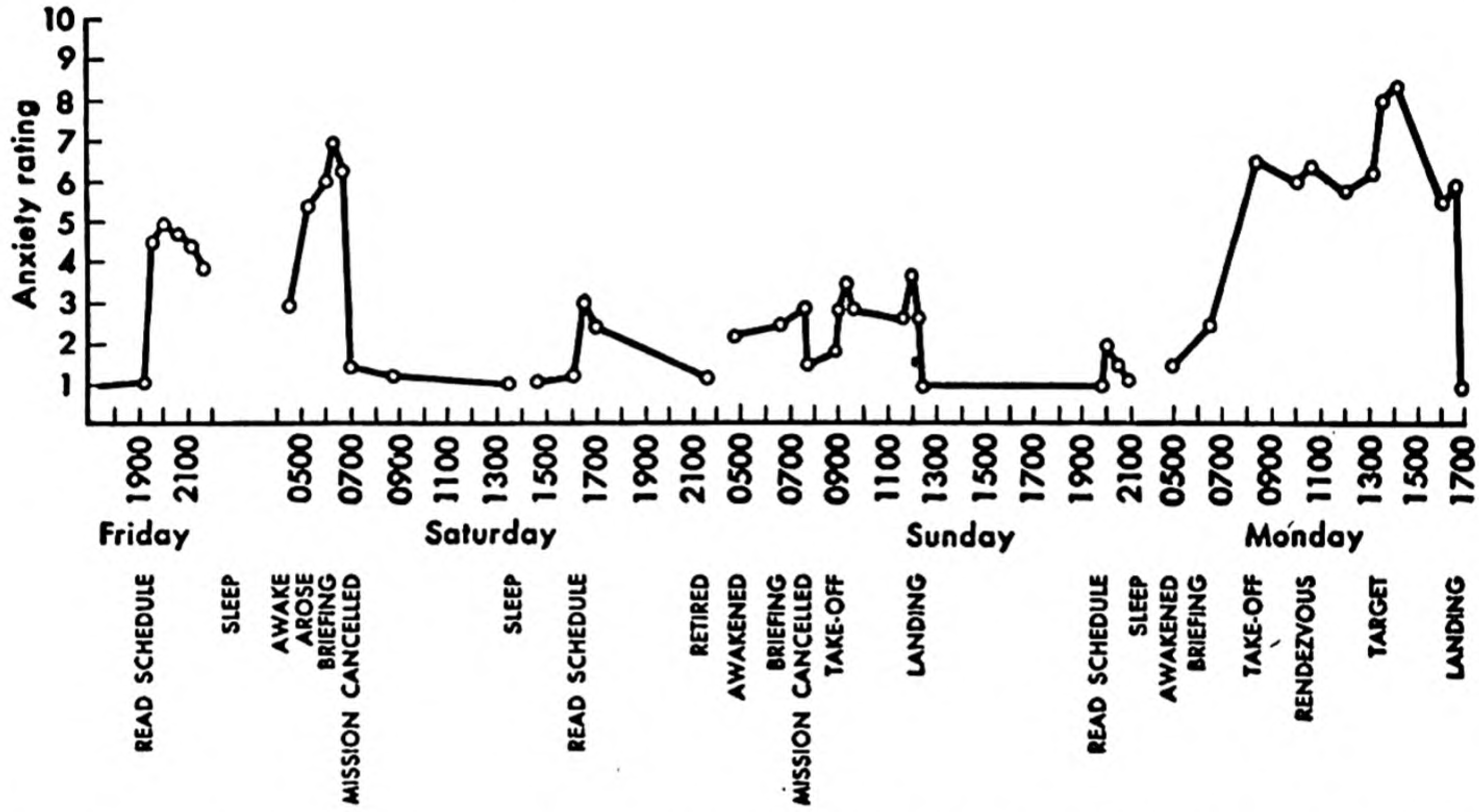


Fig. 14. Emotional ups and downs of a bomber pilot before and during a mission. 1200 is noon, 1300 is 1:00 P.M., and so on. Anxiety ratings were made by the pilot on his own scale of emotional intensity. (*Redrawn from Glavis.*[7])

## MISSION NUMBER 15

For me Friday was a day of rest. I was quite inactive until after supper when I read (1920) the schedule that I was to fly the next day. I had experienced no noticeable anxiety up to this moment. At once, however, I felt a muscular tension in my arms and stomach. I tried to "throw" it several times by tightening my muscles forcibly and then suddenly relaxing. Not much change was effected.

Balancing the tension was the "ego balm" of my scheduled position in the formation. I was to be deputy lead, a position I hadn't expected after only 14 missions. I was assigned a bombardier, navigator, and cameraman

not of my crew. They were men I had not flown with previously. My assigned plane was a new one and easy to fly. I had flown on a combat mission the day before, without mishap, with my entire crew.

It was the day before, however, that a pilot with whom I had gone through training had become involved in a mid-air collision. His plane plunged into the sea, killing all on board. How much of an effect this had on me I do not know. When I heard the news, I felt quite "empty" in my stomach.

Before I went to bed (2145) I had a few words with my crew. In talking, my stomach tightness lessened; the duration of these felt symptoms had lasted about an hour and a half. I slept well until 0430 Saturday, when, in anticipation of being awakened for breakfast and briefing, I tumbled and tossed. At about 0525 I could hear footsteps of the man coming down the hall, stopping at several doors to awaken crewmen. When he turned the knob on my door, I said to myself, "This is it." I experienced a feeling that seemed identical with the one often experienced on the bomb run. It is a feeling of acceptance, a seemingly complete relaxation in muscular tonus, a preparation and resignation all in one. Presumably to accentuate this set, the leader will often announce, "This is it," at the start of the bomb run. . . .

On getting up I felt the stomach tightness of the night before. I went to the latrine and noticed that my bowels were loose. At breakfast I ate no less and no more than I usually do, and I noticed a decline in "physical" anxiety. By "physical" I mean a strong muscular tension in parts of my body, particularly about my abdomen and in my arms. In speaking, too, I would utter words unevenly, in variable modulation, and it would sound very much to me as if my conversation was forced and stilted. I have no knowledge that others could detect what was to me a sure fact. Indeed, I noticed this halting speech in others. Invariably, it would be in the early hours of a morning we had to fly. Frequently, as if to explain away the speech defect, the individual would curse "this damned cold." We never rose early except to fly on a combat mission. Consequently, I could not discover whether the stuttering of others actually was due to the cold or was a symptom of anxiety. The duration of this anxiety with "physical" symptoms had been approximately 25 minutes. . . .

Then we speculated as to what the target would be. It was unanimous among the men that the size of the plane formation suggested a rough target. There was general agreement that we would be briefed for Linz, Austria, not a simple assignment by any means.

The moment I walked into the briefing room I was tense. It was as if I were holding on to a thread. On the wall map where the course was

plotted I could see it was not Linz. Instead, it was a target not heavily defended. Immediately I noticed a relaxation in muscular tension, and I began to feel gleeful at the prestige of being deputy lead. As one felt response dropped in strength, the others appeared stronger. This was a mission I did not want to miss.

Halfway through the briefing, the entire mission was canceled. It was as if someone had wrung me out, and I slumped into poor posture like a limp dishrag. It seemed I was released from all anxiety and yet I regretted missing this "buck-cheese" target, principally from fear that the next one would be a whopper. Outside, the release in tension was noticeable among many. Crewmen slapped each other hard on the back, laughed quite loudly, and talked with much gusto. Whenever a mission was called off, this response was typical for all except those who had one or two more missions to fly. It seemed that, no matter how quiet an individual usually was, he invariably had a word to say at this moment.

Leisurely, I returned my flying equipment to the bins, built a shelf in my room, ate lunch, and lay down for an hour's nap (1330). I played ping-pong before supper and cards afterwards. Drinking gin and juice, I entered into an animated discussion on cooperatives with several other fellows in the officers' club. I went to bed at 2145, not quite sober. At 1615 I had read the flying schedule for the next day; it was the same as the day before. I experienced an increase in anxiety which soon dissipated with activity and drinking. It seemed almost nil at bedtime.

I slept well until I was awakened at 0500 Sunday. Again my bowels were loose, but my anxiety level was lower than on the day preceding due to a completely overcast sky, a cue which indicated that the mission would be called off before take-off time. Briefing (0630) had brought little rise in anxiety, and final preparations at the plane (0710) little more. Three red flares fired from the control tower (0730) indicated that the mission was again called off. My crew jubilantly started a ditty, to the tune of "Three Blind Mice":

Three red flares
Three red flares
See how they fall
See how they fall
We'll all go back to the sack and sleep, etc.

Rather than take the ditty literally, however, I had another breakfast and waited for the practice flying schedule to be posted.

Evidenced in the practice formation flight (see graph) is the apprehension always connected with the take-off and landing of a four-engine

bomber. It must be emphasized that it is not only enemy opposition but the sensitive whims of an airplane that arouse anxiety in the individual. The flight lasted from 0900 until 1200. During recreational activities for the rest of the day, anxiety remained only a word. When we were not flying, we were free to do almost as we chose. With my fellows I played baseball, read mail, played ping-pong, and had one or two convivial drinks. There was a slight tug at the stomach muscles at 2000 hours when I read the combat schedule for the next day, but I was very much at ease in bed by 2030.

Up at 0500 on Monday I noticed an increase in tension until briefing at 0630. Here I learned that the target was to be Florisdorf Oil Refinery at Vienna, probably the second most heavily defended target in Europe. My anxiety level rose rapidly until our take-off time (0815). . . .

After take-off I flew a greater amount of time than my copilot and, being occupied, became more at ease. At our bomber formation rendezvous (1030) I experienced a little more tenseness due to the desirability of flying excellent formation at this time. Climbing to our altitude, over 20,000 feet, I felt relaxed until about 1200, a little more than an hour before we were to enter the bomb run. Then I noticed a slight contraction of my abdomen muscles and I started an inner discussion with myself.

I thought, this is either another "milk run" or we're going to get the hell shot out of us. Suppose we lose two engines. What will I do? I'll point her down and to the right, get the crew out, then try to get out myself. If we only lose one engine we'll try to stagger back. If we get hit in the bomb-bay, it's all over, all black. I saw a few bursts of flak up ahead at the beginning of the bomb run. If this is it, then this is it. Thank God, whatever happens will be sudden. Strange, that right now this run is everything. Maybe later I'll be smiling back on it. . . .

On the bomb run we encountered turbulent air aroused by the planes ahead of us. It was thus difficult to maintain proper position. At least I enjoyed being kept busy right now. . . . I looked ahead, briefly, to see if the group preceding us was encountering much flak. It was. One plane seemed to be hit and was zigzagging enough to cause the other planes to loosen their formation to evade him. I didn't want to look at that ship, but somehow, I kept glancing up regardless.

Soon we came into the flak too. It was at our altitude precisely and seemed to be highly accurate. I could see the red bursts before the black puffs and several times I could hear the explosions over the roar of our engines. My mouth was dry, and my body was quite rigid. I was flying, one hand on the control column, the other on the throttles. I noticed that

my grasp on both was like an infant's grip on some supporting object. "Relax," I said to myself. For an instant my hands relaxed and then became as tight and as firm almost immediately. Later, on the ground, I thought this very amusing.

Right after bombs away, a shell burst beneath our plane and I could feel a lurch upwards. At that moment the controls seemed to have no reaction. Was this it? I called my copilot on interphone to ask if we were hit. He said we were not, so I rallied sharply with the lead ship. They couldn't catch us now, those Germans. I felt as one does when, in a dream, he's running away from someone and is just making it.

Away from danger, I was still tense. On the way back to the base I became jumpy and irritable. The leader, I thought, had no initiative. The way my copilot flew annoyed me and I took the controls from him on several occasions. I was tired and my tolerance was low. I didn't know what I was irritable about and I gave up trying to find out.

At 1630 we landed. When we were fully on the ground, the mission for me was done. Now I could look to the next one. I was in bed by 2000, quite fatigued.

***The physiology of emotion.*** The internal physiochemical changes that go along with emotion and produce such curious feelings are largely under the control of the *sympathetic nervous system.* This is a small set of nerves and their connections outside the central nervous system which enjoys a certain measure of independence or autonomy; in fact, it is part of the autonomic nervous system. But its chief distinguishing feature is its unity. When a nerve impulse goes along a nerve of the central nervous system, perhaps only a finger moves or an eyelid shuts. When the sympathetic nervous system discharges, however—usually because a situation is perceived as exciting—it goes off all of a piece. Nerve fibers going to the heart are innervated and the heart rate increases. Other fibers go to the adrenal glands forcing these to discharge adrenalin into the blood stream. This adrenalin raises blood pressure, aids in the coagulation of the blood, constricts mucous membranes in the nasal passages (the reader has probably noticed, when he has a head cold, how a good scare makes breathing easier), forces the liver to give up stored sugar into the blood stream where it will be available to the muscles, and speeds up the kidneys' elimination of waste products. Sympathetic fibers also go to the stomach and small intestine, inhibiting muscular activity in these organs. A striking experiment illustrating this inhibition has been performed by

putting cats under X ray. They are fed a barium milk shake, which outlines the stomach on the fluoroscopic screen and permits observation of the normal peristaltic movements. Then a dog is brought in and induced to bark at the cat. Immediately the cat's stomach freezes and does not move again for 10 minutes or so.

The sympathetic branch of the autonomic nervous system is not entirely autonomous; it is influenced by integrating centers in the brain, especially by the thalamus at the base of the brain. When the thalamus is removed from a dog, for example, his emotional reactions are considerably altered.

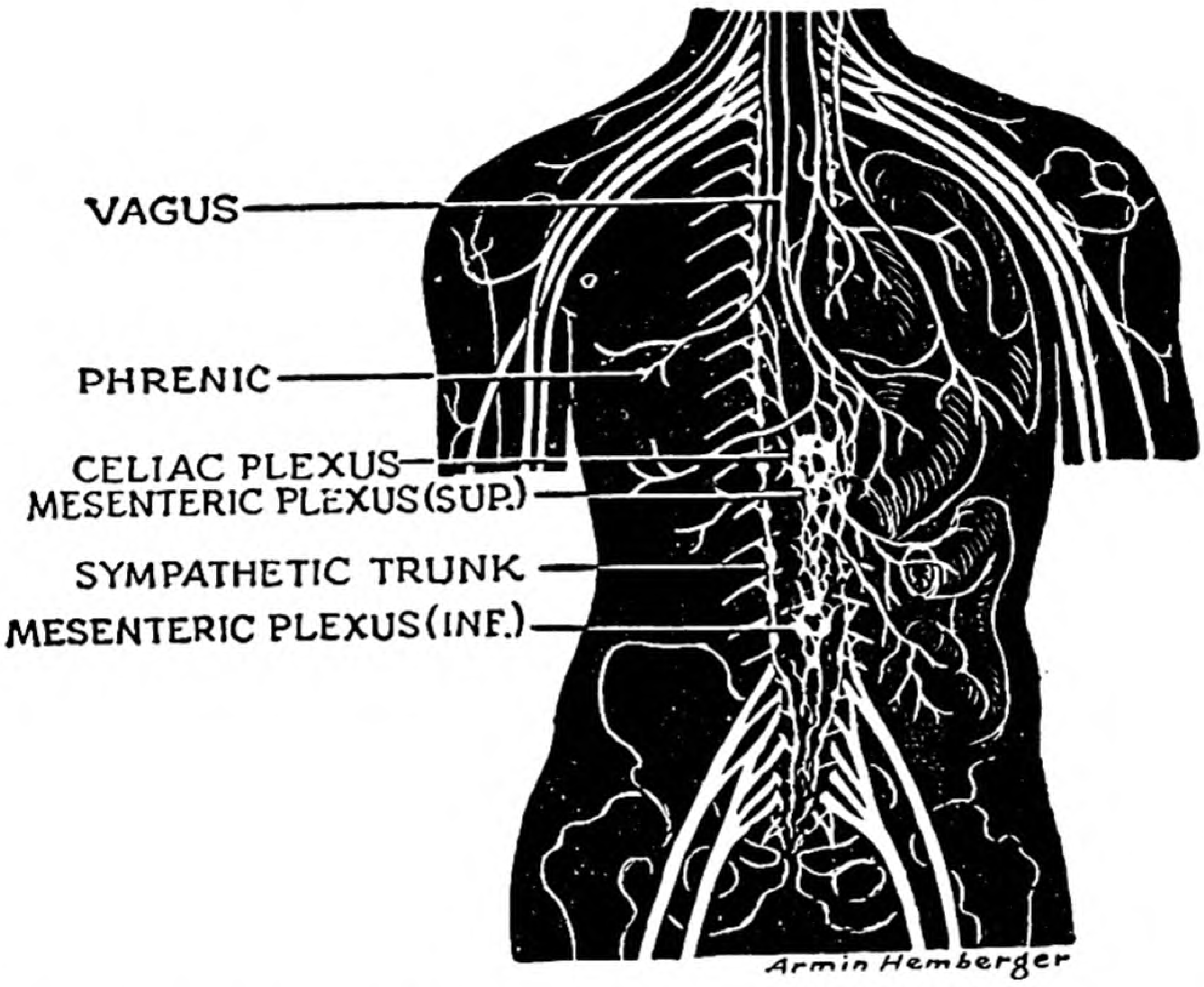


Fig. 15. General view of the autonomic nervous system. (*From a drawing by Armin Hemberger in G. A. Baitsell, Human biology, McGraw-Hill, 1940. By permission of the author and publisher.*)

One of the most sensitive physiological signs of emotion is the *galvanic skin response* (also called the "psychogalvanic reflex," and the "electrodermal response"), a decrease in the resistance of the skin to the passage of an electric current. Two electrodes are attached to the hand, or two fingers are placed in liquid electrodes. The amount of current that can flow from one electrode to the other depends upon the electrical resistance of the skin and tissues between them, and this resistance is easily measured by means of a Wheatstone bridge or some other suitable hookup. When the person to whom the electrodes are attached is emotionally aroused, as by tipping his chair over back-

wards, or by making him cut the head off a rat with a dull knife, the resistance of the skin drops, more current flows, and the needle of the resistance meter swings around. The change in the skin resistance is due to the activities of the sweat glands in the skin, which are under the control of the sympathetic nervous system. Properly used, this device furnishes a delicate indicator of emotion, perhaps too delicate for it is affected by muscular strain and some other nonemotional conditions.

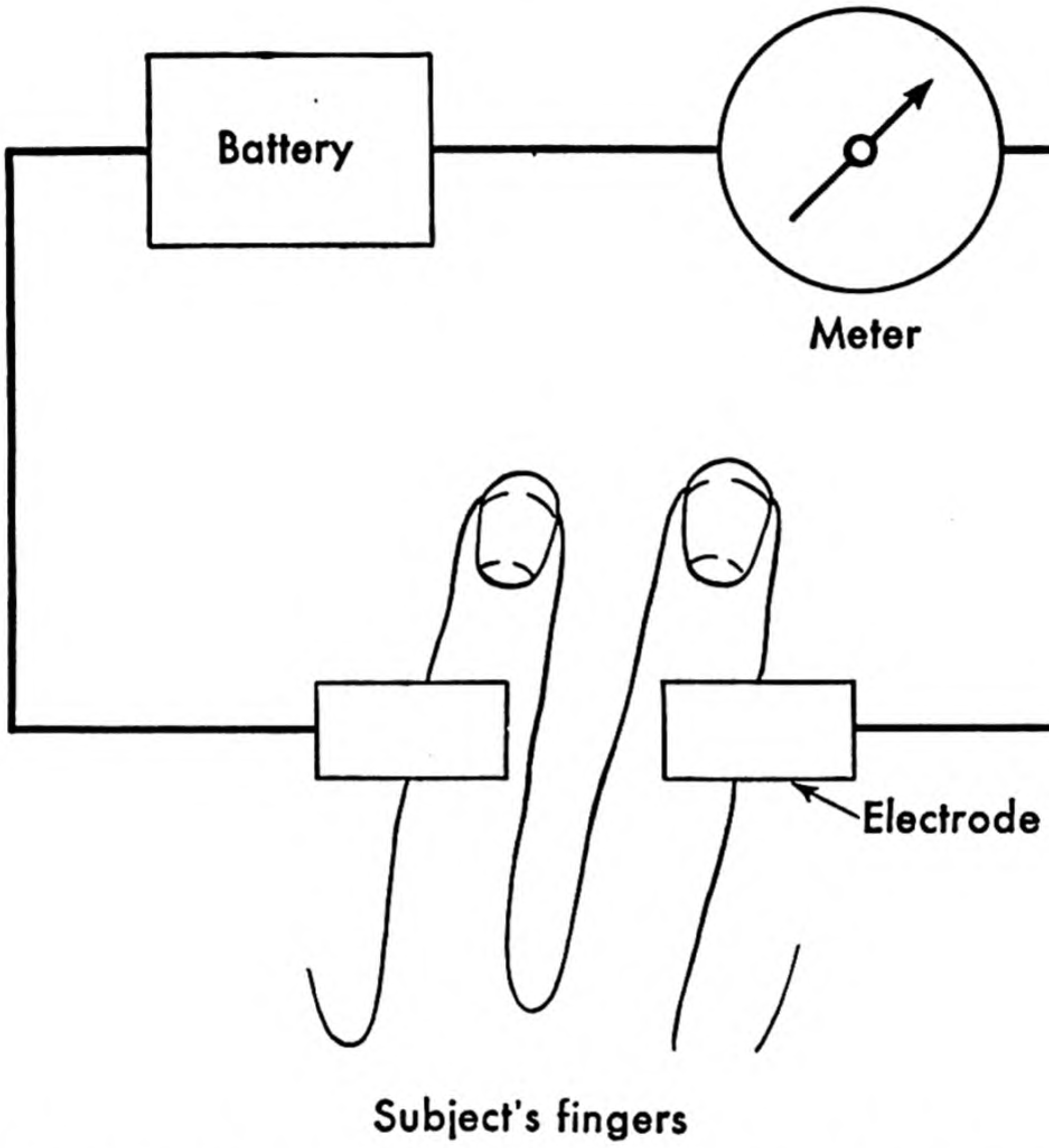


Fig. 16. Simplified diagram of arrangement for obtaining the galvanic skin reflex. The amount of current that flows through the circuit depends upon the resistance of the subject's fingers. When the subject becomes emotional, this resistance decreases and the change is registered by the galvanometer.

Usually these three phases of the emotion, the overt behavior, the conscious experience, and the physiological changes, occur together, but there are two exceptions, which are particularly important. In the first place, overt activity and facial expression may be inhibited if a person wishes not to appear excited, and if such is the case, a physiological indicator is a better guide than external observation. In the second place, the conscious experience may be inhibited or repressed. A person may not admit to anyone that he feels afraid, or angry, or

happy, and may perhaps succeed in deceiving even himself if the emotion is one that he is ashamed of. If physiological signs of emotion can be detected, or if behavior is affected, while the subject represses the consciousness of the emotion, it is therefore called an *unconscious emotion.*

Years ago, when man was considered a rational animal, it was supposed that the conscious experience of emotion came before the other two phases. Then, in a conscious way, the excited person would decide to run, or fight. Today it is generally agreed among the experts that the conscious experience is not the cause of the overt behavior or the physiological changes. It is altogether possible, though the case is not proved, that a person becomes aware of an emotion when he perceives a disorganized condition of his body. Instead of saying, "I run because I am afraid," one can say, with equal logic, "I am afraid because I am running." Whatever the external situation and whatever the bodily upset, if the person knows what to do and can go ahead and do it, he is less likely to feel upset.

Since a person can control his overt behavior, his facial expression, and his reports of his feelings, obviously in doubtful cases physiological indicators of emotion are the most dependable. This is the principle behind the many varieties of lie detectors. Measures of blood pressure, pulse rate, breathing rate, and the galvanic skin response have all been used for this purpose. It is not very difficult to arrange apparatus that will indicate when a person has an emotional reaction even if he is trying to conceal it. The trick is to arrange the situation so that the guilty person will become emotional while the innocent people will not. Sometimes this is impossible but if the criminal leaves his gun or his fraternity pin at the scene of the crime, the sight of these objects will have an emotional effect on him but not on the innocent suspects. Often questions can be made up that will arouse emotion in the guilty one but not in the others. There is nothing mysterious about lie-detector apparatus or the principle on which it is based. But some scientific training and often a good deal of ingenuity are required for accurate results in practice.

Indirect methods are necessary also for the detection of emotion in people with psychoneuroses and other emotional problems, because they usually repress consciousness of their difficulties and cannot talk freely about them. Physiological indicators are not often used because the cooperative patient will talk about something, if not about the

basic difficulties. The examiner has to use the patient's conversation as a wedge to pry into the real emotional problems. Techniques for doing this will be described in Chap. 11.

## THE STIMULI FOR EMOTION

What sort of events provoke these emotional reactions? Any sudden stimulus, a loud sound that does not fit into any familiar pattern of sounds, loss of support, severe pain, or an intense light causes startle and perhaps fear. The experimental-minded reader can get the idea if he cares to stand under a shower and turn on the cold water suddenly and forcefully. Sight of food brings joy to a hungry man with all the accompanying emotional upset. A child who has just found his lost Teddy bear shows jumping-up-and-down joy all over. In general, satisfaction or anticipation of satisfaction of any motive brings joy. Frustration of any strong motive yields anger and often aggression toward the object that caused the frustration. To these natural tendencies must be added the principle that almost anything can acquire emotional significance as a result of one's experience with it. In this sense it is correct to say that most of our emotions are learned, though we are speaking of the stimulus that touches off the reaction rather than the emotional reaction itself.

The whole pattern of emotion can be summarized in the following sequence. A situation is perceived as exciting, either naturally so or as a result of past experience. The perception may arrive through any sense organ and reaches the brain by way of the thalamus. Nervous impulses from the thalamus go down the spinal cord and out to the sympathetic nervous system, discharging it and causing a large number of internal changes. Nerves also run from the thalamus to the skeletal muscles, touching off the running or fighting and the facial tension. The conscious experience of excitement depends upon stimulation of the upper part of the brain, the cerebral cortex, either directly by the thalamus or indirectly by perception of the bodily changes.

## BIOLOGICAL AND SOCIAL SIGNIFICANCE OF EMOTION

Life as civilized human beings know it, and even more so in the wild state, is a hazardous affair, not a routine job. The stitch must

be taken in time, and the iron must be struck while it is hot. In protecting itself from the hazards of life, the animal that can meet an emergency with an intense, even though temporary, access of energy has a much better chance of survival than one geared to life at a constant pace. The physiological changes make sense when emotion is regarded as an emergency mechanism that mobilizes bodily resources for vigorous activity.[9] Supplying quick food to the muscles, improving circulation, respiration, and elimination, and temporarily inhibiting stomach activity, all these changes prepare the body for a fight or escape or chase, as well as for meeting frustration. The action of adrenalin in aiding coagulation of the blood also has a grim emergency function. Digestion of food is routine business; it can wait until the emergency is past.

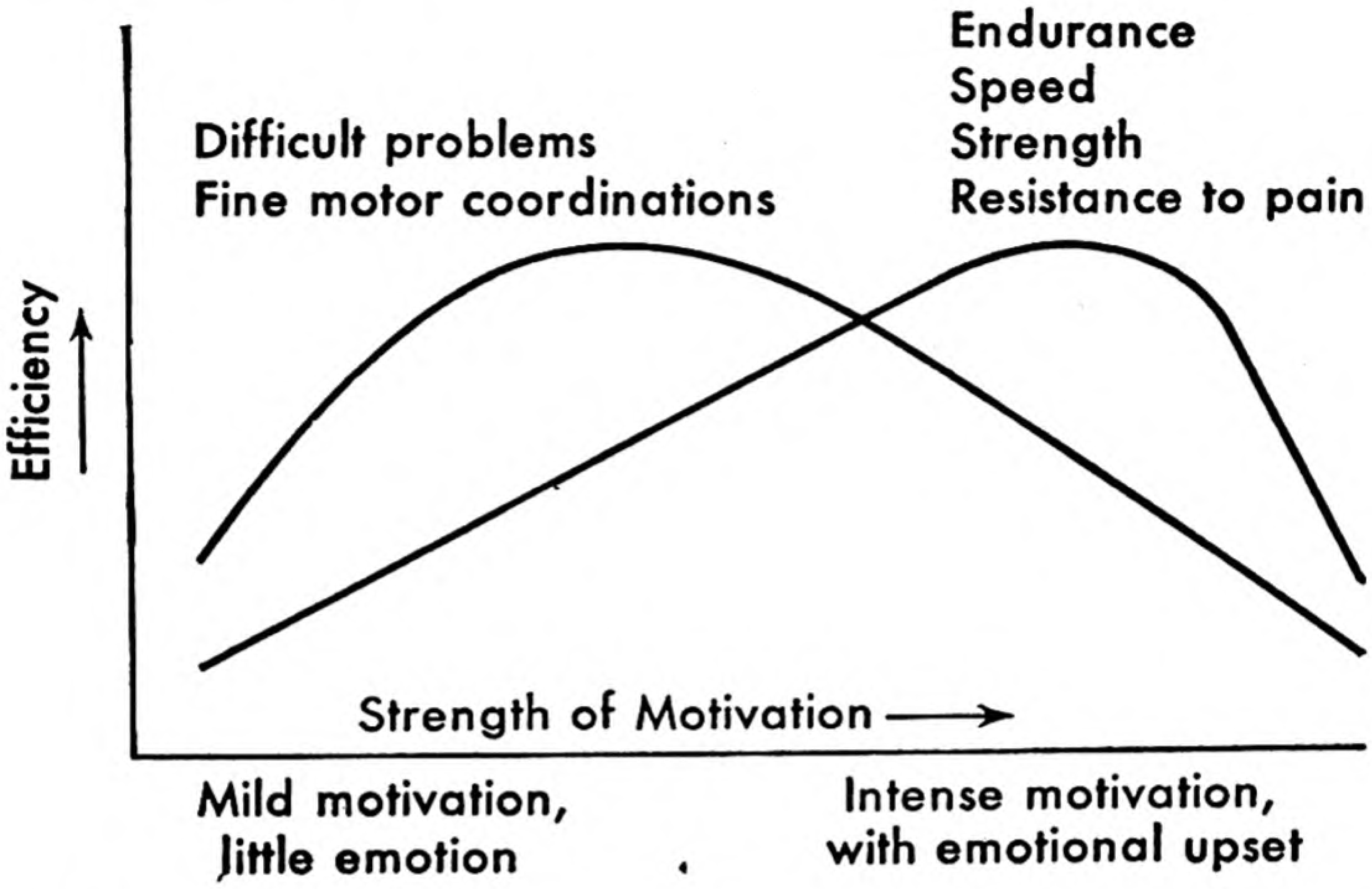


Fig. 17. Motivation, emotion, and efficiency. Endurance, speed, strength, and resistance to pain are improved by the energizing influence of motivation and emotion—up to the point where strong emotion produces a disorganizing effect. Difficult problems and fine motor coordinations are performed best at mild or medium degrees of motivation, with little emotional disturbance. (This is a schematic diagram, which attempts to summarize the results of several researches.)

Modern man has inherited his emotional reactions from his primitive ancestors, who, like the lower animals, lived a life in which speed and brute force were necessities for survival. Certainly in man's early days on this planet, any device for putting the machinery of the body into high gear, or turning on a supercharger for a short time, was very valuable in the struggle for existence. But what of the present

day? Is this emergency mechanism a useful one in the twentieth-century life of traffic lights, delicate mechanical apparatus, and fountain pens?

The answer to this question is one of degree. The emotion can be too strong, just right, or too weak for the best performance of a certain act. When the task requires speed, strength, endurance, or withstanding pain, the best condition would be one of strong emotion, although if the emotion is overwhelming, it may produce paralysis and even fainting, especially in people with weak hearts. When the task requires fine coordination of hand and eye, originality, or critical thinking, the best condition is a rather mild degree of emotion. Strong or medium emotion produces muscular unsteadiness, disorganization, lack of flexibility, and a tendency to jump to conclusions.[10, 11] The relations are shown in Fig. 17.

**Moods, anxiety.** Emotions are episodic; they arise suddenly, and in most cases die down within an hour. When the overt behavior eliminates the original incitement to emotion, the effects are thereby reduced, as in the case where a person succeeds in running away from the fearful object or defeats the cause of his frustration. Inactivity seems to prolong the internal chemical effects of emotion; large-muscle activity aids in dissipating these effects. But when the original stimulus remains prominent, or the effects are not reduced, a mild emotional

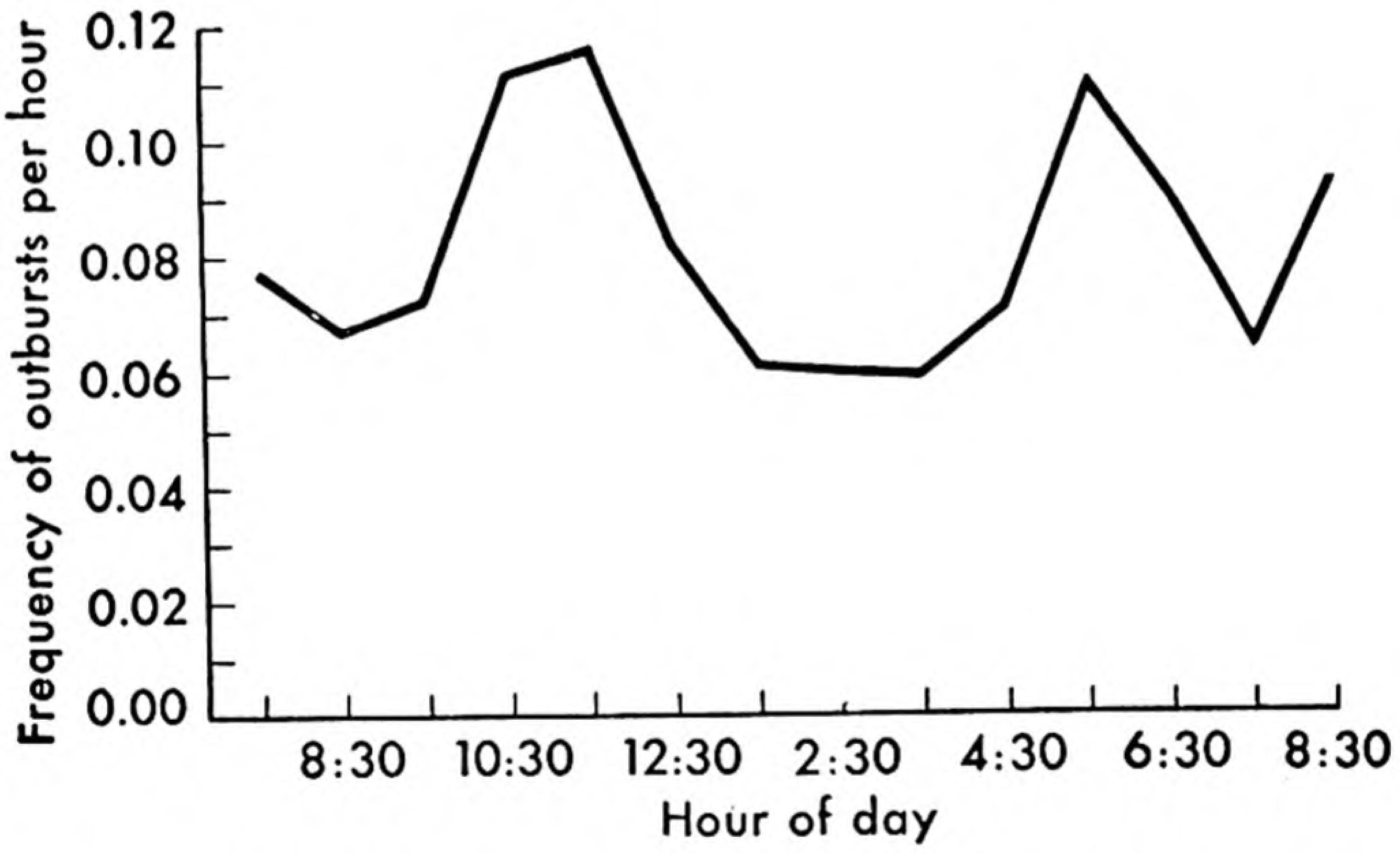


Fig. 18. Frequency of children's outbursts of anger at various times during the day. The peaks occur just before meals and before bedtime. (*From Goodenough, Anger in young children, Univ. Minn. Press, 1931. By permission of the author and publisher.*)

state may persist for several hours. Such prolonged states of mild emotion are called *moods.* We say that a person is in an angry mood, or a joyful mood, meaning that he is in a persistent, mild, emotional state and is likely to explode into full-blown anger or joy.

*Anxiety*, a fearful mood, is a special case of unusual interest for psychology. A person who is continually afraid of loss of his job, loss of prestige, of being hurt, or of flunking out of college is in a mild emotional state that affects the heart, the stomach, and intestines, and interferes with general intellectual performance. Anxieties often operate as motives, steering people away from anxiety-producing situations, and toward situations or activities that are likely to reduce the anxiety. Persistent moods and anxieties increase the tendency to emotional outbursts, as do also such states as fatigue, hunger, poor health, and persistent pain. Young children are most irritable just before meals and before going to bed.[12]

**Pleasantness and unpleasantness.** Pleasantness and unpleasantness are conscious experiences, or different degrees of one kind of conscious experience, associated with motives and emotions. In general, satisfaction of motives is pleasant; conflict, privation, frustration, and pain are unpleasant. It is easy to see that activities, objects, and events that are good for the organism, in a biological sense, are likely to be called "pleasant," and those that are bad are likely to be called "unpleasant."

But that is not the whole story. The taste of saccharin, the sight of a new moon behind tall locust trees, the sound of a string quartet, the feel of a summer night's breeze on one's face and hair, and many other specific stimulus patterns are pleasant for their own sake, without biological significance, just as the scraping of a knife on the bottom of a pan is unpleasant. We like some things and dislike others simply because of the structure of the sense organs and nervous system.

Although these sense-organ drives, like the appendix, have no particular biological utility in our present stage of evolution, they are important for an understanding of the activities of men and women. All men and women learn from the past and anticipate the future, so they tend to seek experiences that promise pleasantness and avoid those that are likely to be unpleasant. In civilized life, when other motives are fairly well satisfied, these esthetic motives are relatively strong.

## INDIVIDUAL DIFFERENCES IN PRIMARY MOTIVES AND EMOTIONS

Knowing the basic principles of drives and emotions, where they come from and how they operate, one would next like to know how people and animals differ, one from another, in these things. Heredity no doubt produces some of these differences, as in the amount of food and water required for bodily growth. Sexual activity is more rhythmical in the lower animals than in the primates. The former, the females at least, have definite mating seasons, during which the sex drive is strong, between periods when it is quiescent. The primates, the higher apes and man, have a relatively constant sex drive, hence the sexes are attracted to each other, regardless of season. (This is one reason why the higher apes and man are the only species that have a permanent family organization.) There is some evidence, gathered from careful interviews with all kinds of people, that men have, on the average, stronger sex drives than women. Men report masturbation more than women. Women report homosexual tendencies more than men.[13] We cannot decide, of course, whether these differences are due to heredity or to social pressure. Research on sex in human beings has to overcome many obstacles, even at the present time, and progress is slow.

Heredity may be the important factor in susceptibility to emotional disturbances, but here again the part played by the example of other members of the family and by social pressure cannot be overlooked. In many emotional people the sympathetic nervous system has an unusually low critical point; it explodes easily. Such excitability is largely under the control of the glands and, in some cases, can be modified by suitable endocrine treatment. Breeding experiments with rats have proved that heredity can play a deciding role in some forms of emotionality. Since neurasthenics cannot recover from an emotional upset as well as others do—in fact, the chief symptom is avoidance of situations that might call for an emergency reaction—several experts have supposed that the pathology of neurasthenia lies somewhere in the sympathetic nervous system or the adrenal glands. The case is not yet proved, but research is under way that may settle the question.

Age is a strong factor in modifying the basic drives as it is in all

biological functions. Newborn babes sleep about twice as much as their older brothers and sisters and three times as much as their grandparents. The amount of food eaten in a day increases greatly during the first two decades of life and falls off slowly after forty. Along with changes in amount eaten goes a change in taste. Adults like fats and sweets less, and highly flavored foods more, than children. The child's hunger cycle is shorter than the adult's. Young babies cannot fit into their parents' three-a-day routine; many have a special yen for the 2:00 A.M. hour. The sex drive is even more dramatically influenced by age. Though some phases of this drive are present in the first few months of life, adult sexuality matures quite suddenly at about twelve in girls and fourteen in boys. These two figures are averages, however, and the variation is large. Some high-school freshmen are mature physiologically while some college seniors are not. The decline of the sex drive is more gradual and equally subject to wide variations. Biologically there is little difference between men and women when both are past sixty.

As to the emotions, the effect of age is to produce fewer outbursts, but these few last longer. Youngsters are easily stimulated to anger fear, or joy, and these quickly pass away. Youngsters go in more wholeheartedly for anything than their elders. One reason for these age differences is that the amount of energy in reserve for an emergency decreases greatly when one passes the prime of life, chiefly because of the deterioration of the circulatory system. Along with this goes a decline in flexibility, which is shown by a slow recovery rate after excitement. The flat emotional life of adults, as compared with the sharp ups and downs seen in boys and girls, is due partly to these physiological effects of age and partly to the wider experience and judgment of the adults.

A corollary to these effects of age, and perhaps the most important of all, is the increase in frustration tolerance. The world of the child, or even of high-school boys and girls, is small; hence, when they want something badly, to be deprived of it is almost more than they can endure. Adults are more accustomed to the frustrations and deprivations of life on this planet. They do not reach such heights of joy nor such depths of despair. This age difference makes it particularly hard for adolescents to understand how their elders suffer their lives of "quiet desperation" with so little open rebellion.

## SUMMARY: PRINCIPLES OF MOTIVATION AND EMOTION

Man, along with the other animals, is endowed by heredity with a small number of basic patterns of activity, or biological motives, like hunger, thirst, and sex, which outline the general plan of life. Activity begins with changes in the blood, produced by shortages of food and water, or by the secretion of the sex glands. These chemical substances orient the perceptual apparatus toward appropriate objects or goals (food, water, and the opposite sex) and prepare the motor apparatus for certain actions (eating, drinking, and copulation). The internal changes are mainly hereditary, but the goal-directed activity has a trial-and-error character and is modified by practice. A large share of the life of man and the other animals is composed of activities directed toward such goals, and such activities are understandable only to those who know the goals toward which the organism is oriented.

Emotions, like drives, are patterns of activity, but they are touched off, reactively, by changes in the external situation. Certain environmental events produce widespread physiological upset, vivid conscious experience, and a characteristic reaction pattern. The energizing effect of emotion increases strength, speed, endurance, and resistance to pain, but the disorganizing effect of strong emotion interferes with fine motor coordination, flexibility of thought, and critical judgment. Most emotional outbursts are soon dissipated but mild anger, or aggression, and mild fear, or anxiety, may be prolonged, with serious psychological consequences.

These are general psychological principles that apply to everyone, but some people are affected more strongly by certain motives and emotions than others. The individual differences are due to heredity, to age, and to the learning process.

## TECHNICAL TERMS FOR SPECIAL STUDY

activity level
biological motive
overt
goal response
hormone
self-regulatory
specific hunger
survival value
sympathetic nervous system
galvanic skin response
thalamus
mood
anxiety

## NOTES ON TERMINOLOGY

*motivation:* a general term that includes motives, emotions, and other conditions affecting amount and direction of activity.

*psychodynamic:* pertaining to motivation.

*motive* and *instinct:* motive is the more general term. Instinct refers only to hereditary or unlearned patterns of activity.

*emotion:* this term is used by some psychologists to refer to single aspects of the reaction pattern, *e.g.*, the conscious experience, or the disorganization of behavior. In this book the term is used for the complete many-sided pattern as described in this chapter. The adjective "emotional" is often used by psychiatrists and psychoanalysts as equivalent to "psychodynamic" and "motivational."

*conscious experience* and *past experience:* the first refers to one's feelings or sensations, of which only he is aware. The verb "to experience" means to be aware of, to feel. Past experience refers to any previous activity or event in a person's history that has left an impression on him.

*unconscious motivation:* pertaining to any motivating condition that influences activity but is not accompanied by conscious experience, or the conscious experience of which is repressed.

NOTE TO FIG. 12: Just as the photographer took the picture, the baby yawned.

# 3

# MOTIVATION AND EMOTION IN SOCIAL LIFE

The primitive action tendencies described in Chap. 2 are fundamental characteristics of the human race, like arms and legs, which account for the similarities in the lives of all human beings. But man does not live by food and sex alone. Man is not just an animal but a social animal, who spends much of his life in interaction with other people. This chapter considers the influence on human behavior of a new set of independent variables, those which arise in social life, modifying the biological drives and putting additional motivational mechanisms into operation.

## *MODIFICATION OF BIOLOGICAL DRIVES BY SOCIAL FORCES*

The demands of society force the growing child to satisfy his biological drives in definitely prescribed ways, at specified times and places. Family and school, friends and neighbors encourage certain forms of behavior and discourage others, by coaxing, by withholding love, by force of example, and, if necessary, by physical punishment. Eventually, and in the majority of cases, society wins. Even bad boys and professional criminals obey more laws and customs than they disobey. No matter how much children rebel during training, sooner or later most of them will eat in a socially approved adult way. Society's ways become their ways; her taboos become their taboos. The result of this learning process is that Chinese develop a Chinese hunger drive, Californians a Californian hunger drive, and the Polynesians develop a Polynesian hunger drive. These drives are similar in their biological basis and in the ultimate swallowing, but they differ in kinds of food

Fig. 19*A*.

Fig. 19*B*.

desired, taboos on food, and manner of getting, preparing, and eating food. The thirst drive is modified by social habits in the same way.

There is a limit to the changes that the culture can impress on the hunger drive. A person can leave part of his formal dinner, or even all of it, on his plate, if he considers that fashionable, but somewhere, sometime, he must eat enough to sustain life. A similar statement could be made for all drives which supply some bodily need, but it would not hold for the sex drive. Complete celibacy, extreme indulgence, and all sorts of variations can be manifested without direct damage to the individual.

Fig. 19C.

Fig. 19. Modifications of a biological drive by social forces. *A* shows eating habits in Iraq. *B* is a similar scene in the United States. *C* was taken in Bali, where "the eating of meals is accompanied by considerable shame. Those who are eating usually turn their backs toward anyone who may be present and hunch themselves over their food." *(A from the Chicago Natural History Museum. B from Rauschenfels, Duluth. C from G. Bateson and M. Mead, and the N. Y. Academy of Sciences. The quotation is from Bateson and Mead, Balinese character, 1942, p. 112.)*

The relation between the biological drives and society is a reciprocal one. Not only does society channel the drives into approved directions, but these drives account for a certain share of the structure of

society. All civilizations have some institutional arrangement for regularizing the satisfaction of the biological drives. In most societies this means a definite division of labor, with certain individuals responsible for procuring and distributing food and water, others for protection, others for health, and so forth. The customs built around courtship, marriage, and childbirth are central to the social pattern of the culture, and all cultures, from the Puritans of old New England to the Indians of Tierra del Fuego, impose some sort of restrictions on sexual activity.

## MODIFICATION OF EMOTIONS BY SOCIAL FORCES

As the child grows toward the adult culture, his basic emotional reactions are modified in two ways. The stimuli capable of arousing emotion change, and the emotional response is controlled. He learns that some of his childish fears, like fear of loud noises and strange objects, are groundless, but that there are many other things to be afraid of, like germs, unemployment, ghosts, and sin. And, as he matures, his capacity for anticipation of the future increases. Anxieties, which are low-grade chronic emotions, are built up in anticipation of danger, and by perception, either in reality or imagination, of threats to body or ego. In fact, growing into civilized life does away with many primitive fears and replaces them with many subtler civilized anxieties, such as anxiety about prestige, about economic insecurity, about loss of loved ones and loss of power. In the same way primitive joys are replaced by the more sophisticated civilized variety.

The emotional reaction is controlled by the culture chiefly in the extent to which emotion is permitted expression. Emotionality may be repressed by one group of people, like the public-school English and the Plains Indians of North America, yet emphasized by the gay Huichol Indians of Mexico and the Pueblos of New Mexico. The growing child, as much as his glands and his intelligence permit, does what his elders do.

While all this is going on, the growing boy or girl is learning from adults and other children how his emotions ought to be expressed. To be sure, there are some emotional expressions that are innate and need not be learned, such as smiling, laughing, crying, and straining; but in addition to these there is a complex conventionalized language of facial expression, which most adults know and which the candidate for adult-

hood must learn if he is to be an average citizen, able to enjoy the movies and to tell a story and to understand the sophisticated social intercourse of his elders. Suppose a friend tells him a joke that is not very good, so he wants his friend to understand (1) that he gets the point, (2) that he thinks it is a poor joke, beneath his level, and (3) that he likes his friend and is willing to pretend that he likes the joke.

It is done very easily, almost without effort, by the proper kind of a smile and perhaps a wave of the hand. But the correct gesture in Bali would not be correct in Madagascar.

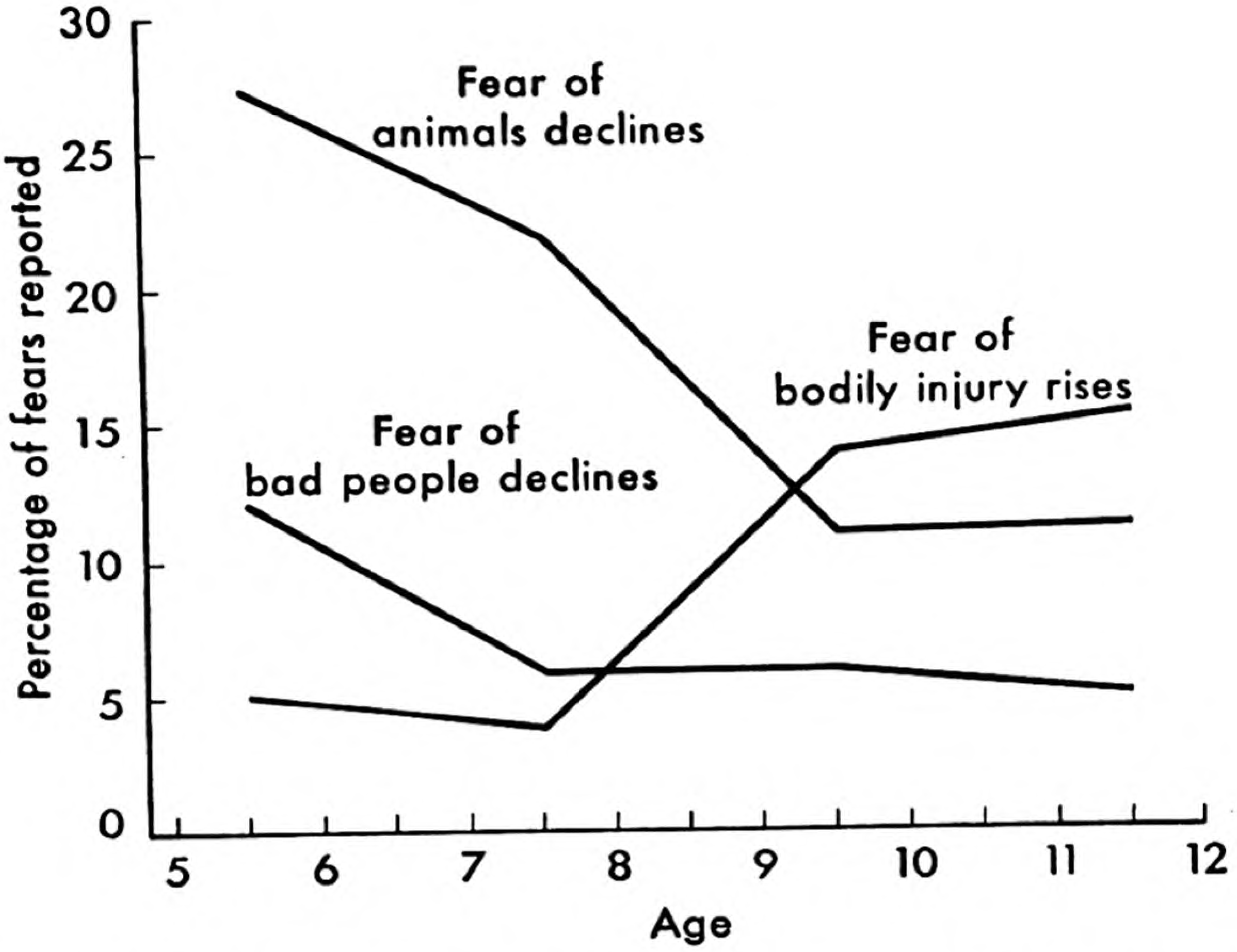


Fig. 20. Some of the fears mentioned by children at different ages. (*Data from Jersild, Markey, and Jersild, Children's fears, Teachers College, Columbia Univ., 1933, p. 153.*)

## DEVELOPMENT OF SOCIAL MOTIVES

So far we have seen how social pressures modify the reaction patterns outlined by the basic drives and emotions. There are several other general patterns of activity, which cannot be explained in terms of any physiological mechanisms but which take their shape almost from the beginning as a result of the individual's interaction with other individuals.

The tendency to seek the company of other people, which used to

be called the "instinct of gregariousness," is a primary *social motive*. It is learned as a result of social interaction in childhood and it, in turn, forms the basis of more complex patterns of social interaction. Almost everyone is sociable, more or less, and feels uncomfortable when alone for any length of time. Even the hermits have God and the birds for company. The drive to "socialize" is so powerful that one might suppose it is a natural, or biological, motive.

The origin of this motive, however, is quite simple. *Sociability* is the result of growing up in a family and having one's wants taken care of by people. When a baby is hungry, it is fed by someone. When it is uncomfortable, someone makes it comfortable. In fact, nearly all its satisfactions come to it just after it sees someone. Since human infants have such a long period of dependence on adults, it would be hard to imagine how a child could grow up without learning to like people and to feel uncomfortable without the reassurance of their presence or availability. So we end up with a strong motive, an urge to be with other people, which is present in some degree in practically all people, and which is a strong force underlying the behavior of people in any society, underlying, in fact, the very existence of any social organization. This motive is like the biological motives in that activity level is increased and a goal is specified, the goal of being with other people. The conscious experience while the motive is aroused is usually called "loneliness." Social motives differ from biological motives in that there is no known change in blood or glands and the motive originates in social interaction.

As the child grows older, he learns that other people are responsible, not only for the good things of life, but also for punishment. If he does something which his parents, or other adults, or his playmates do not like, the joys of social life are withdrawn. Biological satisfactions may be denied or physical pain may be inflicted. More often these punishments are only threatened. If the child is capable of learning anything at all, he soon learns to be sensitive to the likes and dislikes of other human beings and to measure his own conduct by the standards of society. He learns to say "please" and "thank you," and to avoid words and deeds that annoy people. Soon he is able to perceive what kinds of clothes are in style and what acts are right and wrong. His life is guided by the customs of society in general, and by his parents and friends in particular. Thus another social motive is established: the

tendency to seek *social approval,* or to fear social disapproval. The conscious experience accompanying social disapproval is usually called "shame."

Everyone can testify, from his own experience, to the strength of this motive and can recall feelings of shame connected with embarrassing incidents of the past. The motive is an exceedingly important one also for society as a whole, for it is this motive which makes people predictable, which encourages social conformity, and makes a science of social behavior possible. Human beings are very complex; their conduct is a result of the operation of thousands of independent variables. But they do not do all the thousands and thousands of things that they could do. For fear of social disapproval they channel their activities into the accepted grooves of society. Acts which conform to social custom are far more frequent than those which deviate. Behavior is skewed (see Chap. 1) in the direction of the social norms.

## SELF-ASSERTION, THE MASTERY MOTIVE

We know little about the origin of one of the most important of the social motives, which goes by such names as *self-assertion, self-realization, ego-expansion,* and *mastery.* The impulse to make oneself the master of the environment, to overcome obstacles just for the sake of overcoming obstacles, is present in all of us and is seen in children at an early age. The child wants to lift a heavy weight, not a light one, to eat a big piece of cake, not a small one, and to make a loud noise rather than a gentle one. In general, he wants to make as big a dent in his surroundings as he can. Adults do the same, but by more subtle means, expanding their egos in the ways that seem most important to them, whether it be by making high wages, growing beautiful flowers, attaining publicity, getting high grades in college, or promoting an organization, each according to his own definition of success.

If we ask about the origin of self-assertion, the answer is not altogether clear at present. Most of the practice children get from their early social relations is practice in submission, rather than expansion, even in relatively democratic families, so this motive may not be entirely a learned motive. Still, in all families, including the most repressive, children are rewarded now and then for asserting themselves. The young child erects a tower of blocks, knocks it over, hears the crash,

and laughs. He is rewarded by sensory stimulation of his eyes and ears when he sees the results of his efforts, and, in most families, by attention and admiration. The more opportunity he gets to assert himself as a child the more he will strive to realize his potentialities as an adult. The direction in which his ambition pushes him depends upon his concept of success, a concept which he learns from his parents, his playmates, and other prominent examples in his environment, as well as from books and movies. In growing boys and girls, as in adults, look for those activities which the social group emphasizes and you will find the activities in which the members of the group want to be tops.

### THE EGO AS A MOTIVE

The infant has no ego. Unable to make a distinction between himself and the rest of the world, he regards his toe, and perhaps bites it, just as he would any other object within his range of vision. But when he touches his feet, he receives sensations that he does not receive when he touches his rattle. Sooner or later he learns by experience where his body ends and the environment begins. Then, along about age two or three, he begins to think of himself as a person, as an individual in society. People talk to him, and he talks to them. They react to him according to the effect of his action on them. As a result of this social interaction, he acquires some knowledge of, and an attitude toward, himself. The child soon learns that he is a "little boy" or a "little girl." As a result of success and failure, social approval and disapproval, he thinks of himself as a "good boy" or a "bad boy," as a boy who can do things or as one who usually fails. He learns his position in the family, in school, and later his family's status in the community. He is told that he is Catholic, Protestant or Jew, white or black, and which side of the tracks he lives on. At first his idea of himself in relation to others is an unstable one, which fluctuates from moment to moment, but, as his experiences accumulate, his concept of himself and his place in society becomes a fairly stable value, an *ego,* which, come what may, he cherishes and defends.

The ego is a central aspect of personality and will receive the attention it merits in Chap. 11, but what has it to do with motivation? When a person goes along in his accustomed grooves, conforming to his own standards of conduct and being treated by others as he expects to be

treated, the ego does not contribute to motivation. Thirst, likewise, is not a strong motive as long as one gets all the water he needs. But when one's ego is threatened, when one's social status becomes insecure, when a girl is told that she looks like a boy, or when a radical is accused of being conservative, a strong motivating force is aroused. A normal adult thinks of himself as a special person, as being peculiarly himself with his own congenial ways of doing things, and will defend this concept of himself more tenaciously than his pocketbook or the food on his plate. "What is a man profited, if he shall gain the whole world, and lose his own soul?" A threat to the ego increases general activity, like the other motives discussed in this and the preceding chapter, and sets up a pattern of activity in the direction of removal of the threat. The goal is a restoration of the previous concept of the self. Hence ego motivation acts as a gyroscope or stabilizer, holding the individual to the course that his concept of himself sets for him.

## FRUSTRATION; CONFLICT AND INTEGRATION OF MOTIVES

Life being what it is, people do not always get what they want. When a person is motivated toward some goal and then something interferes with his progress toward that goal, we say that the person is *frustrated*. When two or more motives are steering his efforts in contrary directions, we say that he is in a *conflict*. What happens in these cases? If the motives are minor ones, the person may calmly accept the decision of fate and go fishing. But if the motives are strong and the goals are important to the individual, more or less emotion is aroused, energy output is increased, and activity is redirected. The new activity may be directed in many ways, for reactions to frustration and conflict are highly variable and personal, but psychoanalysts, psychiatrists, and psychologists have described several general mechanisms, or patterns of reaction, that are so common that every educated citizen should be familiar with them.

**Aggression.** Very frequently when an animal or a human being is frustrated in his motivated activity, the reaction is one of aggression. Take a bone away from a hungry dog and see what happens. Or get in front of a mother lion looking for her lost cub. In human beings, likewise, thwarting any strong motive often produces anger and aggres-

sion. In fact, whenever anyone is unusually aggressive, some frustration in his background can ordinarily be detected. Here is an example.

> A college student was driving to a distant city to attend a football game. It was the Big Game of the season and represented an important event in the season's social festivities. He was accompanied by a girl whose good opinion he valued highly and whom he wished to impress with his extensive plans for a week end of parties and amusement. They became very gay and hilarious during the course of the drive and he was silently congratulating himself on the successful arrangements he had made. Suddenly a siren sounded behind him and, when he stopped, the traffic officer reprimanded him severely and in a very insulting manner for "driving like a high-school kid." The sound of the siren and the officer's intrusion immediately destroyed both his rapport with the girl and the happy anticipations he had had. As soon as he was permitted to drive ahead, he began berating the manners of the officer and telling the girl that the police in that state were notorious for their bullying methods. During the remainder of the drive he seemed to have difficulty with his car; he grated the gears frequently in shifting, refused to let other cars pass him, and made insulting comments about every policeman who came in sight (though, of course, slowing down whenever they appeared). The change in behavior here is not very baffling. The student was frustrated by being humiliated before his girl; his expectations of favorable response from her diminished. His behavior became aggressive because of his hostility toward the policeman which he could not express directly and which kept bubbling up after the arrest.[1]

While it is true that aggression is usually a consequence of frustration, the big question in any particular instance is: What direction will the aggression take? For frustrated people are hardly in any condition to analyze their frustrations calmly and clearly; they may not even admit that they are frustrated. So, while the aggression generated by the frustration may be directed toward the actual source of the frustration, as when the dog bites the man who took his bone, it may also be directed hither and yon by other factors in the situation. If the frustrating agent is too big to attack, as in the case of the traffic policeman, the aggression may be taken out in talk, or displaced onto a smaller *scapegoat.* The aggression may be channeled in one direction or another by resentments already on hand, as when a girl who hates school blames her teacher for all her frustrations. Particularly when the frustrating agent is unknown, vague, or abstract, can the aggression be redirected by a skillful propagandist, or by the existence in the culture

of a scapegoat tradition. ("It's the bureaucrats." "It's the Jews." "It's the Wall Street bankers.") Often a group of people may be frustrated by the same historical events, the automobile dealers, for example, or the war veterans, though each may resolve this frustration by his own particular kind of aggression. Often, on the other hand, resentments piled up from many different sources can be channeled by a temporary leader into mob violence (see Fig. 21), or against a public figure, or into political action of an aggressive sort. The frustration-aggression principle is a useful tool for the understanding of many social movements, so we shall need it in later chapters.

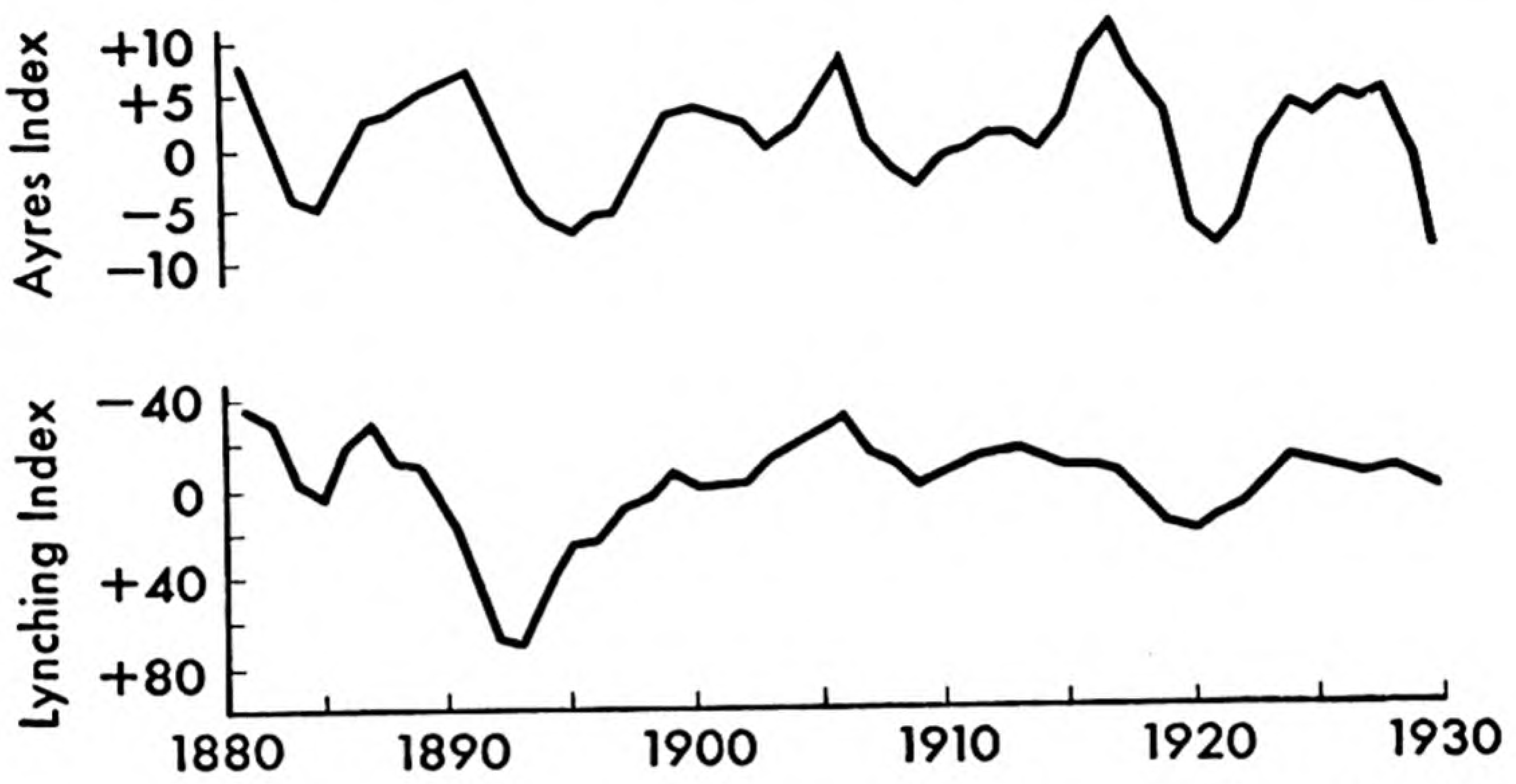


Fig. 21. Fluctuations in lynchings compared with fluctuations in business conditions over a period of 48 years in 14 Southern states. The Ayres index is a standard index of general business conditions. The lynching index has been reversed to make comparison easier. It is clear that as business improves the number of lynchings decreases, and vice versa. (*From Hovland and Sears: 1940. J. Psychol.,* 9, *307. By permission of the authors and publisher.*)

***Substitution and sublimation.*** A person who asks for strawberry ice cream and cannot get it is likely to be content with raspberry ice cream. The term *substitution* refers to the principle that objects similar to the original goal object may reduce the motivation. We have already seen how the biological motives can be modified by social forces, and social and ego motives can be modified even more so, for their goals are not so precisely defined. The important point to remember is that people differ greatly in what they consider similar. To some people raspberry ice cream is just about the same as strawberry ice cream, and one will satisfy as much as the other. To others the two are quite different, and neither could substitute for the other without a large loss in satisfaction. To some people striving to get ahead, one job is as good

as another as long as it pays the same salary. To others those jobs are similar and can be substituted for one another which carry the same prestige, not those which pay the same salary.

When the original goal of the motive is subject to social disapproval, like sex, and the substitute is approved by society, like writing romantic poetry, the shift goes by the name of *sublimation.*

**Rationalization.** This term applies not so much to what a person does as to the reasons he gives for doing it. If the motive for the act is one that the person is not proud of, and he says that he performed the act for some other motive which sounds nicer, the mechanism is called *rationalization.* If a boy quits school because he is homesick, he is likely to say that he thinks school is a waste of time, or to give some other excuse for his action. The conflict is between his desire to go home and his desire to avoid social disapproval. The rationalization is a face-saving or ego-defensive mechanism, which permits him to do both. After the fox in Aesop's fable, it is often called the "sour-grapes mechanism."

Rationalization may extend to actions as well as excuses, as when one coughs to cover up a belch, and may be carried out so cleverly that, in outwitting society's taboos, one succeeds in deceiving himself. Everyone rationalizes for one purpose or another; it is good exercise to think up additional examples from one's own experience.

**Compensation and overcompensation.** When a person "loses face" because he is placed in a position that he is not proud of, he is likely to make an effort to boost his ego back up to its former level by whatever means possible. Such an ego-defensive mechanism goes by the name of *compensation.* Since the ego can be threatened in many ways by the insecurities of life in a competitive society, and since different people define success in different ways, compensatory efforts take many forms. If a person makes a disturbing blunder in a business deal, he may compensate in kind: go right back to work and fight even harder than ever for dear old Acme Products, Inc. Or he may try to mend his tattered ego by achievement in some oblique direction: by talking about his former accomplishments, by teaching his son how to be successful in business, by bullying his wife, by diverting a larger share of his energies into his model-building in the hope of winning prestige in a hobby contest, or by trying to capitalize on a little trick he knows for beating the odds at the race track. When a boy has been told that he looks like a girl, he may compensate by growing a mous-

tache, by smoking a pipe, or by some other peculiarly masculine activity.

Ego motivation is highly personal. Consider the case of a girl who, for one reason or another, takes a job teaching school. If the idea of being a schoolteacher is fairly congenial to her, not far from her idea of herself, she will fit into her new social role easily. But, if she considers herself as something altogether different from a schoolteacher, strong compensatory efforts will be aroused, and she will struggle to bring her activities into line with her concept of herself.

It is a curious bent in human nature that, when people compensate, they often *overcompensate*. Unsatisfied with regaining equilibrium, they press on toward greater and even impossible heights. Theodore Roosevelt, compensating for the physical inferiority of his childhood, was not content with wielding ordinary power or riding an ordinary hobby. He wanted to wield a big stick and be a roughrider. Hitler, the frustrated paper hanger, was not willing to stop when he became dictator of Germany. He wanted to be dictator of the world. A girl who fears losing friends will often make extreme, and even silly, attempts at friendship. A man who fears growing old may make exaggerated efforts at youthfulness. The emotion which accompanies overcompensation seems to inhibit the normal exercise of self-criticism.

Motivation is usually multiple. It is convenient to discuss the motives and emotions one at a time, and to list the biological motives in one chapter and social motives in another, and, experimentally, it is often necessary to investigate the effects of only one motive at a time. But in the hurly-burly of real life in grocery stores, divorce courts, and cockpits, people are motivated by several of these factors operating simultaneously. At 8 in the morning a person may be pushed on by ambition to succeed in the day's schedule of activities. At the same time he may be anxious about the consequences of his conduct of the night before, and worried about his friends' approval of the clothes he is wearing. Just as the throw of a penny to a crack (see page 5) is determined by many independent variables, so is the direction of one's activities determined by all the motives that may be aroused at the moment. No one can obey all his impulses. No one can go to breakfast and go back to sleep at the same time. Somehow, most of the time, behavior is integrated in a moderately efficient, or at least human, fashion.

The behavior of infants and young children is not well integrated. Whatever motive or emotion is aroused, it leads immediately to action, with little regard for the consequences. Children alternate rapidly, for example, between anger and joy. As their intelligence matures, they are able to pattern their activities into larger and larger units so their behavior shows continuity over a long time interval. Their capacity for delay and for anticipation of the consequences of their acts increases. Furthermore, as they mature, their motives and emotions, originally all-or-none affairs, are now graded in degree according to the urgency of the situation, and they can be guided by a motive to one goal with the expectation of later following the other.

The normal adult motivated by two conflicting motives will usually hesitate for a while before following either direction; the more nearly equal the strength of the two motives, the longer the period of indecision. If human beings were simple machines, like a beam balance, the process of decision would be an automatic weighing of one against the other, with the stronger motive gaining the advantage. Sometimes the process is as simple as that. But people are more flexible than machines, so usually the motivating forces are reorganized into a new pattern of motivation. One motive attains temporary dominance while the others are delayed. Or a way is found of partially satisfying all of the aroused motives. If the person in conflict does not become too excited and brings his intellectual resources into play, the process is called problem solving, and is discussed in Chap. 8. If there is any master principle that governs the solution of conflicts, it is ego motivation. Motives are handled in such a way that the least damage is done to one's concept of himself.

A specific example will illustrate how several motives may be integrated into the final path chosen. Take the case of a woman of thirty-two who was the beauty of the town before she was married, but who has realized for several years that her domestic struggles with housework, children, and the cost of living have driven the uplift of youth from her cheeks and her figure, and that a stroll down the avenue in her best dress—past the square, past the crowd lined up at the movie house, past the drug stores and the parked cars—is now only a way of reaching the other end of the avenue. Yesterday, when she tried to buy a suit, she had to admit, frankly and ultimately, that none of them made her look like the girls in

the advertisement or even like the carefully treasured pictures of herself in her young-married days. Today she launches a campaign to make her husband sell the old house they are now living in and buy an expensive new house on Gramercy Parkway.

In our analysis of this affair it is to be noted first that the frustration felt by our heroine is not a sudden turn of events. Although the outward signs may build up to a climax swiftly, it usually comes out upon examination that these things develop, not from one vivid traumatic experience, but from an accumulation of instances. The intensity of the frustration in this woman's case is augmented by the central position that her appearance holds in her system of values, in her ego structure. Other strong interests in her life, *i.e.*, her children, her husband, her bridge club, her job if she has one, if they are not simultaneously frustrated, will operate to take the sting out of her total feeling of failure. But she does feel let down, so what does she do? Appearance of a woman's house and personal appearance must be in the same category in this woman's mind, hence she is able to transfer her blocked desire for success in one to potential success in the other. If she did not see some similarity in these two appearances, this particular way out of her problem would not have been chosen. It is probable that her yearning for that new house was not acquired in a day. She no doubt has had some resentment against the old house and attraction toward the new one previously, but these motivating factors have been greatly reinforced by the recent access of compensatory energy.

What will be the outcome of all this? If she does not get that new house which seems to mean so much to her, she will try some other way of restoring her ego, turning perhaps to her children. (This trial-and-error tendency to turn this way and that is typical of all motivated animals in problem situations, whether they be personal problems, social problems, or problems in an arithmetic book.) She may become more active in club work, hoping to gain praise for performance if not for appearance. She may turn to religion for solace, but the religious way out may not be active enough for her temperament unless she can combine it with her need for immediate personal glory, as some evangelists have done, or with active participation of some organizational sort which keeps her in the limelight and keeps her busy. If she does get her new house, will she be satisfied? The answer to that

depends upon whether the praise she receives for the house is grouped in the same category in her mind with the praise she used to get for her appearance.

## WANTS, DEMANDS, APPEALS, INTERESTS, ATTITUDES

If you ask someone why he is doing what he is doing, he probably will not say "self-assertion," or "anxiety," or "sublimation." He is more likely to say, "I need the money," or "I want to get a B," or "I am afraid it is going to rain." For people usually interpret their specific activities in reference to specific goals to be attained or specific discomforts to be avoided. Back of these specific temporary motives are many of the general motives described in this and the preceding chapters, complicated by the ability of human beings to learn from the past and to anticipate the future. Everyone wants money, of course, because it can be used for the satisfaction of many motives. No one speaks of wanting air because it is free. The motivation behind studying for examinations may be self-assertion, compensation for failure in social relations, fear of family disapproval, anticipation of the value of good grades in getting a job, or any combination of these and others. The psychology of learning attempts to demonstrate how these specific activities, interests, and attitudes develop out of the fundamental motives and emotions, but in many of the practical situations of business, vocational guidance, and politics we would like to analyze people's wants and attitude without regard to their origin. What do people want when they go shopping for a new automobile? What sort of work is this girl interested in? What is the public attitude toward control of monopolies?

It is very difficult to keep human beings under controlled experimental conditions. They do not fit well into activity cages or obstruction boxes, and they are hard to follow around in the highways and byways of daily social life. But psychologists have invented several ingenious techniques for estimating the strength of people's desires and interests.

The most obvious method, of course, is to observe what people actually do. Psychologists have stationed themselves in museums, at fairs, and near advertising exhibits, noting the amount of time people spend observing the different displays. They have counted the minutes

people spend looking at the various pictures in magazines, they have measured the amount of laughter produced by movies and radio comedy, and have counted the number of people who listen to different programs. Advertising agencies spend a large share of their time at this kind of research, hoping that they can find out what people want so that they can plan their advertising more effectively.

As an experiment, to find out what appeals will be effective on college students, three psychologists at Dartmouth College, Osgood, Allen, and Odbert,[2] made records of radio commercials advertising aspirin, chewing gum, shoes, and the like. They used 10 appeals that are commonly used in radio advertising, such as economy, prestige, and sex, as in the following example of the "self-esteem" appeal.

*First voice:* Are you going to join the throngs heading back to the old campus this year? If you are, have you checked up to make sure your teeth look right?

*Second voice:* You'll want them to come up to the standards of particular men and women. You'll want them to be a sparkling pearly white.

*First voice:* And you'll want to be sure your breath is fresh and clean.

*Second voice:* We suggest you try Curtis Tooth Powder. It's the dentifrice picked by those who value the health and beauty of their teeth. Curtis Tooth Powder makes your mouth feel right.

They played these records to several groups of college students, followed by dance music, then asked the students to recall as many brand names as possible. Since every one of the 10 appeals had been used with every one of the products, they were able statistically to eliminate the effects of the products and compute the average strength of each appeal in making the students remember the brand name. Self-esteem was the strongest, and comfort the weakest, as follows:

1. Self-esteem
2. Prestige
3. Health
4. Universality
5. Sex
6. Efficiency
7. Economy
8. Beauty
9. Safety
10. Comfort

Another method of analyzing people's wants and interests is to get them to keep a record of their daily activities for a month or so, from which the researcher can calculate the number of hours spent

in eating, going to movies, reading, working, sleeping, and the like. Or people can be asked to keep track of the money they spend in these different ways. According to one well-planned survey of this sort, carried out in 1935 and 1936, American consumers spent about 29 per cent of their money on food, 10 per cent on clothing, 3 per cent on recreation, 2 per cent on tobacco, 1 per cent on education, and so on.[3]

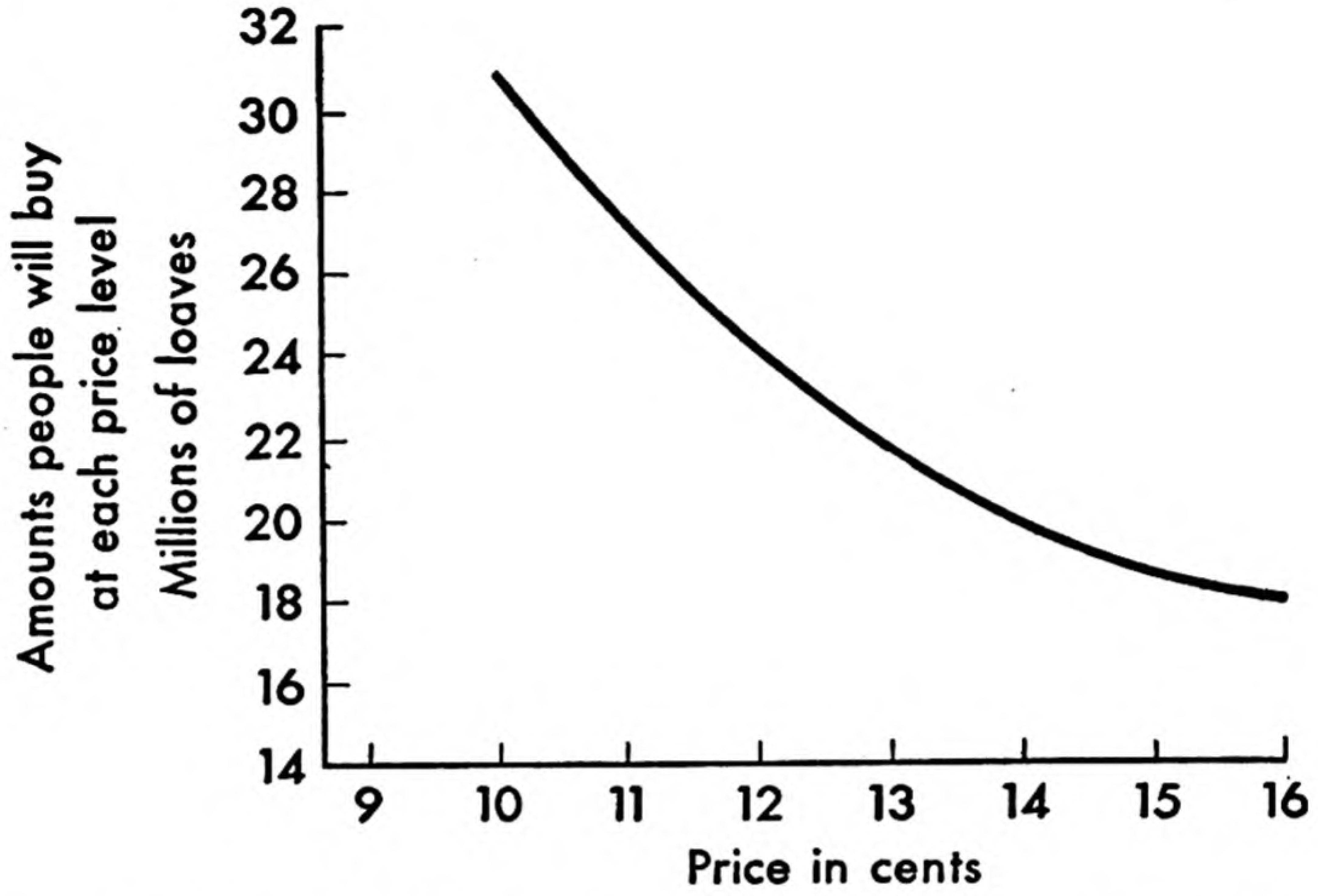


Fig. 22. Demand curve for bread. A hypothetical curve showing how much bread American consumers might be expected to buy at various prices.

The amount of a commodity, like bread, that the people will buy depends, of course, on how much they have already consumed, what can be substituted for bread, how much they will have to pay, and several other psychological and economic factors. Taking bread as a hypothetical example, we might find, if we surveyed the consumer market, that the American people would buy 31 million loaves a day at 10 cents a loaf, 27 million loaves a day at 11 cents a loaf, 24 million at 12 cents, and so on, to 18 million at 16 cents a loaf. The relationship is shown in a chart, which economists call a "demand curve."

The easiest, though perhaps not the most dependable, way of investigating wants and interests is simply to ask people. "How strongly do you want a new radio?" "How much would you be willing to pay for the opportunity to talk to a famous artist?" "What would you give for a year's vacation in South Africa?" "Would you rather read a book, or write in your diary?" "What do you like most, and what annoys you most, about your job?" When the questions are

carefully worded and the subjects take them seriously, the results can be valuable.

One investigation of this sort made use of the Vocational Interest Blank devised by E. K. Strong (see page 391). Strong had hundreds of people in many different occupations tell which three of the 10 activities in the table below they would enjoy most. The table

*Relative Importance of Ten Working Conditions* *

(Each individual checked the three items he considered most important. The figures give the percentage of each group who rated the item one of the most important.)

| *Working condition* | *Per cent* | | | | |
|---|---|---|---|---|---|
| | *President* | *Office worker* | *Physician* | *Artist* | *Carpenter* |
| 1. Freedom in working out one's own methods of doing the work | 66 | 42 | 65 | 87 | 35 |
| 2. Opportunity to make use of all one's knowledge and experience | 68 | 40 | 76 | 75 | 38 |
| 3. Steadiness and permanence of work | 30 | 45 | 35 | 35 | 65 |
| 4. Opportunity for promotion | 34 | 63 | 21 | 11 | 49 |
| 5. Salary received for work | 30 | 31 | 23 | 18 | 34 |
| 6. Certainty one's work will be judged by fair standards | 20 | 21 | 22 | 39 | 15 |
| 7. Coworkers—congenial, competent, and adequate number | 38 | 22 | 26 | 14 | 10 |
| 8. Courteous treatment from superiors | 5 | 18 | 6 | 9 | 24 |
| 9. Opportunity to ask questions and to consult about difficulties | 9 | 10 | 19 | 8 | 13 |
| 10. Opportunity to understand just how one's superior expects work to be done | 3 | 9 | 1 | 4 | 14 |

* From *Psychological Aspects of Business* by E. K. Strong, p. 543.

gives a good picture of the motivation of several occupational groups and is worth studying carefully. Freedom in working out one's own methods and opportunity to use all one's knowledge were considered very important by presidents of manufacturing concerns, physicians,

and especially by artists. Office workers, as one might expect, put opportunity for promotion high on the list, while presidents and physicians are less concerned with this matter, and artists hardly at all. It is interesting to note that it is the presidents who were most anxious for coworkers. Does this reflect the loneliness of a top executive, or merely a desire for cooperation? It is also interesting that all groups put salary in a secondary position.

As a person goes through life, striving for this and avoiding that, he builds up favorable attitudes toward some objects and persons and unfavorable attitudes toward others. Some parts of the environment look good to him, others look bad, and still others remain neutral. So psychologists have found it very profitable to study motivation by asking people about their attitudes. "Do you approve, or disapprove, of compulsory peacetime conscription?" "Would you be in favor of a bonus to parents of large families?" "Do you think national prohibition of the sale of intoxicating liquors would be a good thing for the country?" "Do you approve, in general, of the President's policies?"

*Attitudes* are characterized by an object, which may be a person, place, idea, church, political program, or what not, by a direction, which may be positive or negative, and by an intensity. In the first place any goal object or incentive for a biological drive, like food and water, is inherently attractive, because the perceptual apparatus, when integrated by the drive, orients the organism toward such goal objects. Other attitudes are learned as the result of experience. The infant learns to like his bottle, for example, and the person who holds the bottle, because they are signals that food is on the way. A dog may build up an unfavorable attitude toward the garage because that is where he is given his bath. Since motivation is usually multiple, and many of the objects of this complex world are tied in with the operation of several motives and emotions, the attitude toward these objects is the resultant of many contributing factors, large and small, positive and negative, from the present and from the past. A student's attitude toward a course of study may be determined by his hope of using the course in gaining social approval or prestige or in avoiding his parents' disapproval, by experiences of success and failure in the course, by his attitude toward life in general and college in particular, by the people he meets in the course, and by many other independent variables. Political attitudes, directed toward such attitude objects and

symbols as the Republican party, income taxes, free speech, the United Nations, and the national anthem, are similarly compounded of many ingredients, and we shall see, in Chap. 9, how such attitudes can be measured and how their origins can be traced back to ego motivation, economic anxieties, membership in social groups, and propaganda.

## INDIVIDUAL DIFFERENCES IN SOCIAL AND EGO MOTIVATION

In respect to the biological motives, similarities between people are more impressive than differences, except in matters of degree, but social and ego motives are learned from experiences in family life, in school, and at work and play; hence they differ greatly from one person to another in direction and strength. Since everyone lives the first part of his life in a family and has his biological motives taken care of by people, everyone is sociable more or less. But children become more of a nuisance to their parents as they grow older and some have unfortunate experiences with other children, so, when these children reach adulthood, some are very sociable, some mildly so, and some avoid social intercourse. Likewise some adults become highly sensitive to social disapproval, others mildly so, while others are quite independent. The relative strength of these motives in different people can be estimated, though not with any high degree of accuracy, by careful observation of their actions in social situations, and by the other methods just described.

In order to study ego motivation psychologists have been forced to invent several ingenious new techniques, one of the most interesting of which is the *level-of-aspiration* experiment.[4] The level of achievement that a person aspires to can be seen when he is put to work at simple tasks, like throwing darts at a target, and, after practicing a few times, is asked what score he expects to make the next time. Surprising individual differences appear in this simple situation. Almost everyone raises his level of aspiration after success and lowers it after failure, but some people, with their heads in the clouds, set their goals far above any score they have yet made. The realists, with their feet on the ground, keep their goals close to their past achievements. And still others set a low goal that they are sure to reach. In the first of these groups the need for high achievement must be very strong, while in the last the fear of failure obviously outweighs the desire for

striking success. It is interesting to note that people are fairly consistent from one situation to another which has the same personal significance. The realists in one game are likely to be realists in another game. Those who hedge against failure on one are inclined to hedge on the others. Furthermore, psychologists have been able to raise a person's level of aspiration star-high by a little white lie about the high achievements of his friends. Easy satisfaction at a low level is produced in the same way.

The table on page 61 shows how presidents of manufacturing concerns, physicians, office workers, artists, and carpenters differ in respect to what they want from their jobs. In this research the method was the simple one of direct question.

Just because the motives arising out of social interaction vary so greatly from one individual to another, the understanding of such motivating factors as sociability, social approval, level of aspiration, and political attitudes will be quite useful in the chapter on personality.

## SUMMARY: PRINCIPLES OF SOCIAL MOTIVATION

As a result of their social experiences people modify their primary motives and emotions, usually in ways approved by society. Because man's infancy is long and his early biological drives are satisfied only when other people are around, he becomes a sociable animal, seeking the company of others and sensitive to their disapproval. As he matures, he strives to assert himself and acquires a concept of himself, or ego, which is a precious value to be defended when threatened.

Aggression is usually the result of frustration of a strong motive, but when once aroused, aggression is rather vaguely directed and may be redirected by other social influences. Anxieties, due to vague fears and emotional insecurities, may be similarly redirected. Within certain limits the motivated organism is able to substitute other goals for the original goals.

After a person develops an ego through interaction with other persons, he values it highly and, in order to defend this ego, will often rationalize his activities and compensate, or even overcompensate, for inferiorities.

Motivation is usually multiple. Activity is steered in a direction that

is a resultant of the several motives operating at the moment. To get a picture of the integration of behavior, it is useful to think of the primary motives and emotions as a board of directors who lay down the general policies of the organization. Executive control and integration of the actual conduct of operations is carried out with the aid of whatever intelligence is available, always with an eye out for public reactions. Since objects, persons, and political programs may be tied in with the operation of many different motives, one's attitude toward any of these objects, whether positive or negative, is the outcome of a complex pattern of motivation.

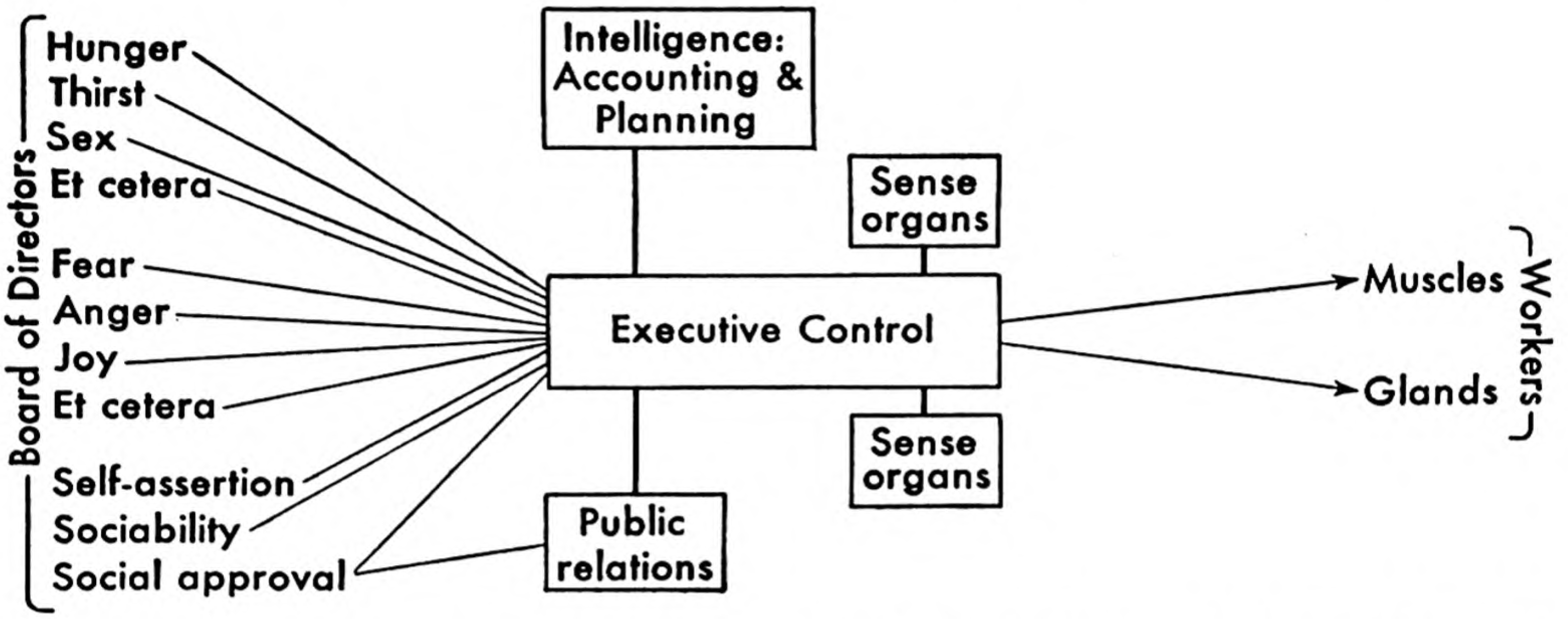


Fig. 23. Organization chart of the activities of the individual in a social world. As an aid in studying the two chapters on motivation, it is worth while to attempt a simplified visual integration of the complex pattern of motivational relationships. The primary motives and emotions may be pictured as a board of directors, which, though they may conflict with one another—different ones being dominant at various times—establish the general policies of the organization. A normal adult is able, under ordinary conditions, to act as a general manager, integrating these policies and executing them with the aid of whatever intelligence he has, always with an eye out for public reaction to his conduct. An extremely strong motive, for example, sex or fear, may of course overwhelm all executive or self-control. And, on the other hand, the development of the organization and the interaction between executive control and the public give the executive or ego a status of its own with the additional function of initiating policies (ego motives) which defend its status.

These principles, and those at the end of the preceding chapter, describe the general patterns of human activity. The motives and emotions, as they make their entrances and their exits across the stage of life, establish the outlines of the plot. Other psychological principles, to appear in the chapters on perception, learning, and thinking,

have their roles in carrying out the action, filling in the details, and ringing the variations on these major dynamic themes.

## TECHNICAL TERMS FOR SPECIAL STUDY

social motive
sociability
social approval
self-assertion
concept of self
ego
frustration
conflict
scapegoat
substitution
sublimation
rationalization
compensation
overcompensation
attitude
level of aspiration

## NOTES ON TERMINOLOGY

*social norm:* standard of conduct, deviation from which brings social disapproval.

*interest:* habit of paying attention to, talking about, and learning about, some object, place, or activity.

*self-control:* direction of activity in accordance with one's idea, or ideal, of himself.

*rationalize:* in other contexts this term means to plan, to do things in a reasonable way. But in psychology and psychiatry it means to make up socially acceptable reasons for one's conduct.

*incentive:* an object, or goal, like money or food, toward which activity is directed. The incentive is outside the organism; the motive is part of the organism.

*demand:* a term used in economics for a schedule showing the amounts of a given commodity that people stand ready to buy at various prices.

# 4

# SENSORY FUNCTIONS

Now that we know, from Chaps. 2 and 3, some of the general patterns of human activity in this world of grocery stores, drinking fountains, soft May breezes, and automobile accidents, we must turn our attention to the senses that tell us about this colorful world. Motives and emotions direct activity toward and away from certain objects; the sensory functions enable the motivated man or animal to work his way among the objects of the environment, finding food and drink, and protecting his job and his reputation.

## *THE SENSES IN GENERAL*

As a rule people pay little attention to their eyes and ears, or to lights, sounds, and smells. The motivated organism observes the objects of the environment and adjusts his behavior to them, using any or all of his various senses for whatever good they do him, seldom bothering to separate vision from hearing, or sensory functions from other psychological functions. But it is possible, under the controlled conditions of the psychological laboratory, to separate the senses and study them one at a time.

It is true that man has five senses, as Aristotle said, but it is a libelous understatement. Any student of anatomy can draw pictures of twice that number of sense organs, and the ones that get the least publicity are among the most essential to life and limb. By and large they all function in the same way. As a result of a long process of evolution, the higher animals have a number of very specialized organs, called *receptors* or *sense organs*, each of which is sensitive to a class of physical events such as lights and sounds, and is able, when stimulated by these events, to translate the stimulation into electrical impulses. These

impulses speed along the sensory nerves to the brain, making it possible for the individual to adjust his behavior to the events that started all this.

The important thing to remember, the capacity which is the basis of this whole chapter, is that the sense organs can *discriminate* between different stimuli. The effect of red light on the eye is different from the effect of yellow light. The effect of a weak sugar solution on the tongue is different from the effect of a strong solution. When psychologists test the sensory capacities of the lower animals, they get them to make one response to one stimulus, such as a loud sound, and another response to a weaker sound. If the animal can thus discriminate between the two, he gives clear-cut evidence of his sensory capacity. If he cannot discriminate, he will make the same response to both.

Human beings, who have the power of speech, can report their sensations to the experimenter. They can say that this liquid tastes "sweet," and that color is "blue." *Sensations* are the conscious experiences aroused by stimulation of the sense organs. Such data are subjective. No one can check on someone else's sensations, and two people may use the same name for different experiences, or different names for the same sensation. Instead of asking people to describe their sensations when touched by a warm object, modern psychology arranges the experiment so that the subject will be forced to discriminate between a warm object and a cold one, or to match one color with another. But when differences between sensations are clear-cut and the names for the sensations are standard, subjective data are often valuable.

The acuity of the sense organs is usually measured in terms of *thresholds*. The *absolute threshold* for hearing is the smallest amount of sound one can hear. For light it is the smallest amount of light one can see. More important than the absolute threshold is the *difference threshold*, the smallest difference, between two sounds, or lights, or smells, that one can detect. A person's difference threshold is measured by getting him to compare several stimuli with a standard stimulus. How large a difference must there be between the standard stimulus and the comparison stimulus in order that he can discriminate one from the other? This is the measure of his *acuity*. If someone

can discriminate one stimulus from the other when the difference between them is small, we say he has good acuity.

*Sensory adaptation* occurs in all senses. A warm object on the skin feels less warm after it remains a while. A chemistry laboratory may smell strong when first entered, but after 5 minutes one may not notice it at all. The optical apparatus can adapt to a wide range of lights, and even a stone in one's shoe feels less painful after 5 minutes.

*Contrast* occurs in all senses. In the winter a breeze of 60° feels warm; in the summer 60° feels cool. A tomato tastes distinctly different with salt and with sugar. A flute does not sound the same when it is heard against a background of other flutes as it does when heard in the midst of a full orchestra. For an example of visual contrast, see Fig. 24.

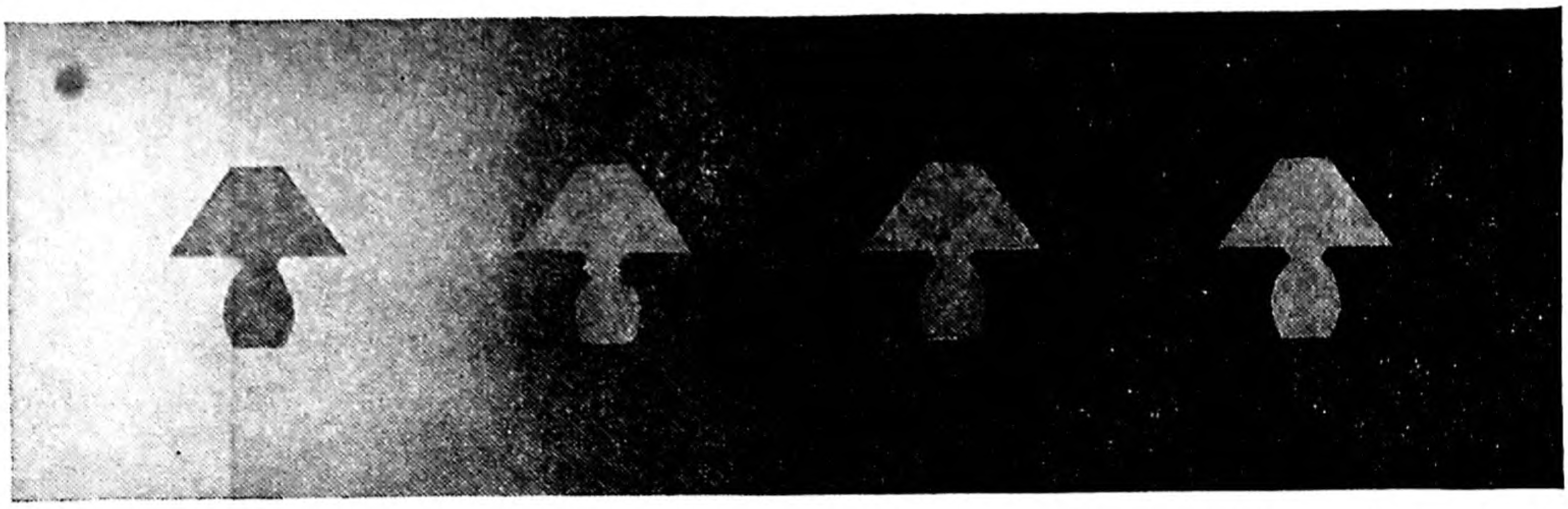


Fig. 24. Contrast effect. Is the light on in any of these lamps? The effect of the background can be eliminated by viewing the lamps through four small holes in a piece of opaque paper.

## TASTE AND SMELL

Perhaps they are not so important today, but far back in man's evolution, when the mouth and tongue were organs of exploration, the chemical senses, taste and smell, occupied a dominant position, as they still do in the lives of some of the other animals. To excite the taste organs, the stimuli have to be in solution in the mouth and have to come in contact with taste buds located on certain parts of the tongue, mouth, and throat. Even then there are only four tastes: sweet, sour, bitter, and salty. If you take a little salt on the end of a toothpick and place it on your tongue a little behind the tip, you will not taste a thing, for it is the sides of the tongue which are sensitive to salt. With a little exploration anyone can find areas on the top of

the tongue which are insensitive to sweet, sour, and bitter also. These four taste-blind areas overlap, producing a small area just back of the tip, in the exact spot where most people would deposit a choice morsel of food, which is not sensitive to taste at all.

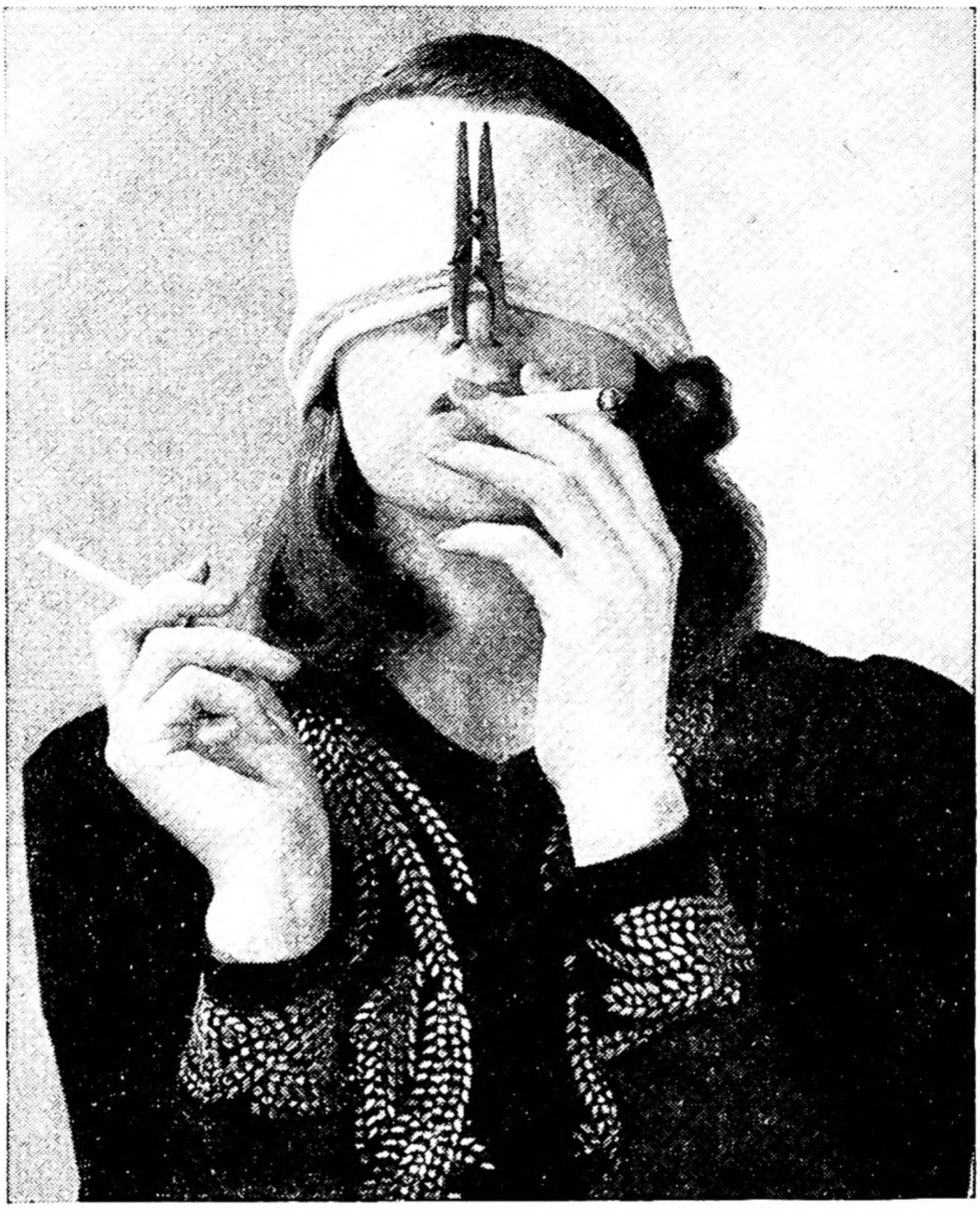


Fig. 25. Which cigarette tastes best? In order to be sure that we are testing taste alone we must eliminate the other senses. The blindfold eliminates vision. The clothespin eliminates smell. Is any other sense affected by cigarette smoke? (*From Camera Clicks.*)

Most of the sensations obtained from eating are not tastes but smells. The number of smells is so great and their combinations are so complicated that no one has made much progress in classifying them, but we do know that the receptors are in the mucous membrane high up in the nose. Some gaseous chemicals, like ammonia, irritate the lining of the nose, so their effect is not only one of smell but also a little tingle of pain.

### THE SKIN SENSES

For objects on the skin there are four senses to analyze their properties: warmth, cold, pressure, and pain. To locate the receptors and map their positions, we can take a brass rod pointed like a pencil, warm it a little above body temperature, then touch it to the skin of a willing subject, and ask if it feels warm. Then the stimulus is moved a fraction of an inch and touched to the skin again. When the skin is touched at some places, the object will feel warm; at other places it will not. By careful systematic exploration, spots sensitive to warmth can be found and marked. The same procedure is followed with the rod cooled a little below body temperature, with a fine hair to test for pressure sensitivity, and with a needle to test for pain. It turns out that receptors for warmth and cold are sparsely distributed, while receptors for pressure and pain are scattered rather widely over the body.

### KINESTHESIA

One of the important senses often overlooked is the sense of position of the limbs and of muscle tension. The receptors are minute spindle-shaped organs located in muscles, joints, and tendons, which send communiqués to the brain about the disposition of our arms and legs and the tension in our muscles. Without this sense we would have a hard time touching our fingers behind our backs or performing any rapid skilled movements. We learn to perform many complex acts, like playing a piano and dancing, by making good use of our eyes at first, but we find later that we can carry on with our eyes shut because we know, from *kinesthesia*, where our fingers and arms are. This is the sense we use when we heft a book and guess how heavy it is, and this is the sense that tells us our muscles are tense and we ought to relax.

### SOMESTHESIA

*Somesthesia* means body sense, just as kinesthesia means sense of movement. And certainly we do get sensations from inside the body, *e.g.*, sensations of hunger, of stomach-ache, nausea, of that stirred-up state of the body during emotion, and sensations accompanying sexual

excitement. The sense organs that are stimulated by these bodily conditions have not been tested as thoroughly as the other sense organs because they are hard to locate.

## SENSE OF BALANCE

Many senses cooperate in helping us stand upright, ride a bicycle, or perceive whether an elevator is carrying us up or down. Vision is the most precise of these because the eye can detect a very small deviation in the relation of the head to a horizontal line. Any airplane pilot appreciates the utility of his eyes as a balancing organ when he runs into fog. But even with eyes closed, we can detect movement and rotation if they are large enough. Somesthesia helps here because the soft parts of the abdomen swish around when the movements are sudden. The specialized organ of balance, however, is the labyrinth, a set of three semicircular canals (see Fig. 26) in the inner ear. It is a neighbor of the organ of hearing, but not a relative.

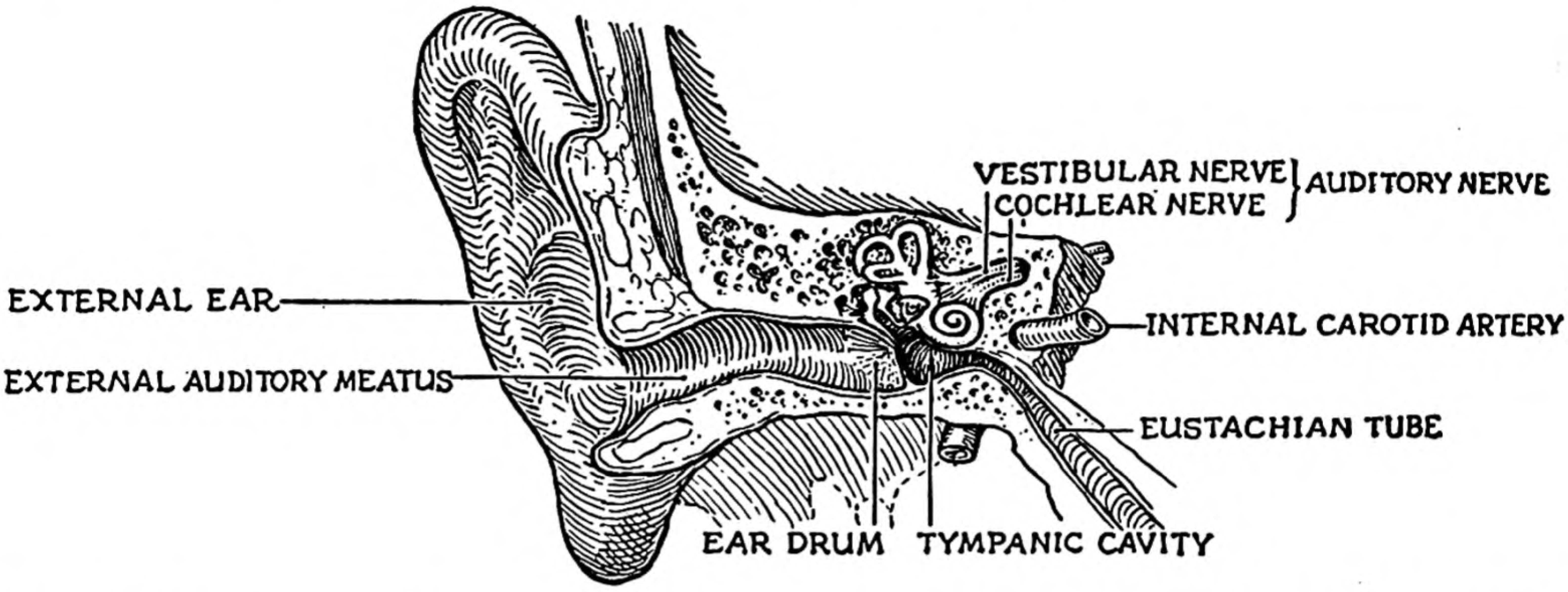


Fig. 26. Human ear. The semicircular canals, which play an important part in the sense of balance, are also shown, just above the eardrum. (*From a drawing by Armin Hemberger in G. A. Baitsell, Human biology, McGraw-Hill, 1940. By permission of the author and publisher.*)

These are small canals in the bone filled with fluid, a part of each being lined with small hair cells that extend out into the fluid. When the head moves, the fluid lags behind and bends the hair cells in the opposite direction. The hair cells are the receptors and, like all receptors, communicate with nerves that run to the spinal cord or brain. Since there are three canals, set at right angles to each other, movement in any spatial plane can be analyzed with a fair degree of accuracy.

## HEARING

The most precise information we get about events taking place at a distance comes through the ear and the eye. The environmental stimuli that impinge upon these sense organs are in the form of regular but very rapid waves of energy. Sound waves, started by some disturbance of the air, spread in all directions, as unlicensed and uncensored as the ripples on the surface of a pond, at the rate of about 1,130 feet per second. This is equivalent to about 12 miles per minute, a speed these rocketing days would label mediocre. Scientists name the sounds in accordance with the frequency of the waves or vibrations, middle C on the piano having a frequency of 256 (scientific pitch) or 264 (concert pitch) vibrations per second. The human ear can pick up frequencies as low as 20 per second and as high as 20,000 per second, a range of about nine octaves. The low-frequency waves are quite long. When the peak of one wave reaches the ear, the peak of the next may be as much as 60 feet away. The high-frequency waves are correspondingly short, 0.05 inch for a tone of 20,000 cycles per second. But these extremely high and extremely low sounds are not easily heard unless the energy behind them is great. The human ear is most sensitive to sounds between 300 and 4,000 cycles, within the range used in human speech. In fact, a good ear can hear a sound in this range that changes the atmospheric pressure on the eardrum by only one-billionth. This is so faint that it moves the eardrum less than a millionth of an inch, less in fact than the diameter of the hydrogen molecule.[1]

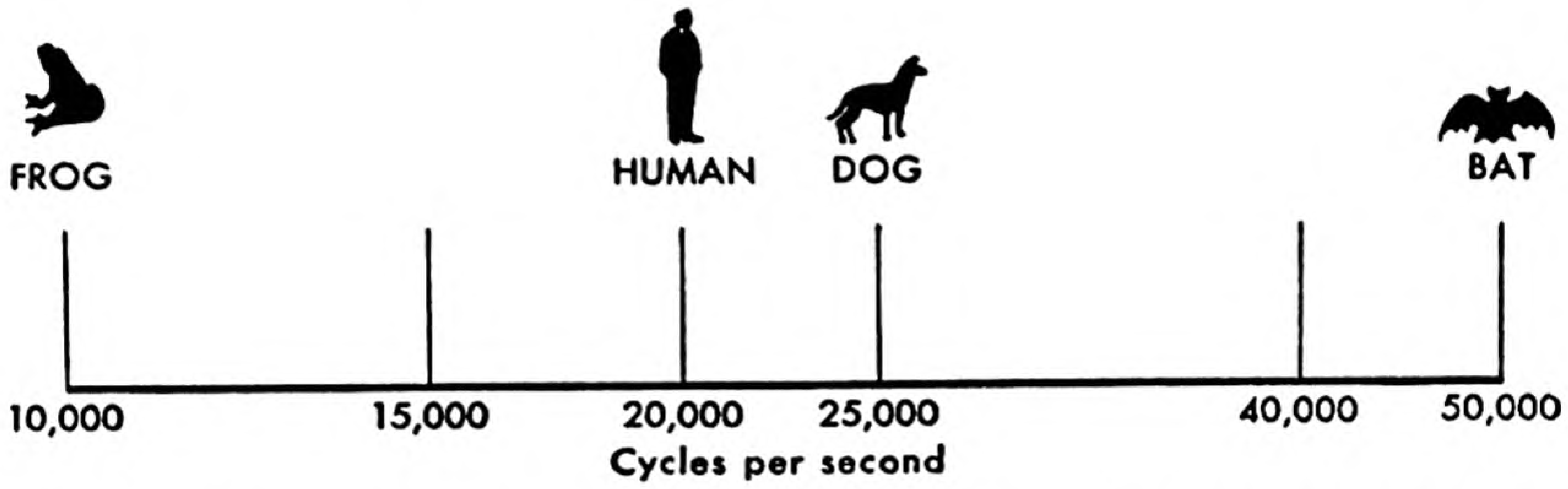


Fig. 27. Upper limits of hearing, expressed in cycles per second. (*Redrawn from Science Illustrated, May, 1947, p. 32.*)

Although a man's ears are as good as or better than those of most other animals, some dogs can hear sounds a little higher in frequency than we can. But it is the bats, those mysterious flying mammals, that take top honors in this department with an ability, recently discovered by two zoologists, Galambos and Griffin,[2] to hear sounds of frequencies in the rarefied supersonic region, up around 50,000 cycles per second. As a matter of fact, it is this unique power which explains the bats' uncanny talent for flying at night in their own frightening way. They send out these very-high-frequency sounds—just how they make them is not clear, but they cannot do it with their mouths taped shut—and listen for any reflection, which would warn them of an object to be dodged. It is a natural and automatic radar.

*A note about the word "sound."* Unfortunately for clear thinking the word "sound" is used for both the physical stimulus, *i.e.*, the sound wave, and the psychological response, *i.e.*, the auditory sensation. Thus it is possible to ask the confusing conundrum: "If a tree falls in the wilderness and there is no one around, will there be any sound?" Of course, sound waves will be broadcast when the tree hits the ground, but a sensation of sound can only occur when ears are in the neighborhood.

Sounds, as they come to us from ferry boats, automobile traffic, breaking glass, human voices, symphony orchestras and one-man bands, can be discriminated, one from another, in three respects: *loudness*, *pitch*, and *timbre*. A note will be heard as loud, if the sound wave that hits the ear is one of large amplitude or intensity, *i.e.*, if there is a lot of energy behind it. Sound waves of low intensity produce faint sensations. Backing away from the source of the sound reduces the loudness, in proportion to the square of the distance. The frequency of the sound makes a difference also, because the human ear hears best in the middle range of frequencies, between 300 and 4,000 cycles. A sound of these frequencies will be heard as louder than one of the same intensity that has a frequency of 25 or 10,000 cycles per second.

A note will sound high in pitch when the frequency of the sound wave is high, so that it makes the eardrum vibrate rapidly. The amplitude of the sound wave has only a slight effect on pitch.

The timbre of a musical note is produced by overtones in the sound stimulus. Musical instruments, like the string on a violin, dc

not send out waves of just one frequency, but several. When a violinist plays middle C, the string vibrates 256 times a second and sends out a wave of that frequency. But it also vibrates in halves, and each half, vibrating twice as fast, will make a sound of 512 vibrations per second, which is called an *overtone*. All musical instruments produce several overtones, as well as the fundamental tone, and it is these overtones which give each instrument its characteristic quality or timbre. This is the reason why middle C on the piano can be distinguished from middle C on the violin even though the intensity and frequency of the fundamental tones may be the same. A large part of the difference between the novice and the expert lies in bowing the strings so as to produce pleasing overtones, and a large part of the difference between a good violin, or piano, or horn, and a poor one lies in a design that resonates the pleasing overtones.

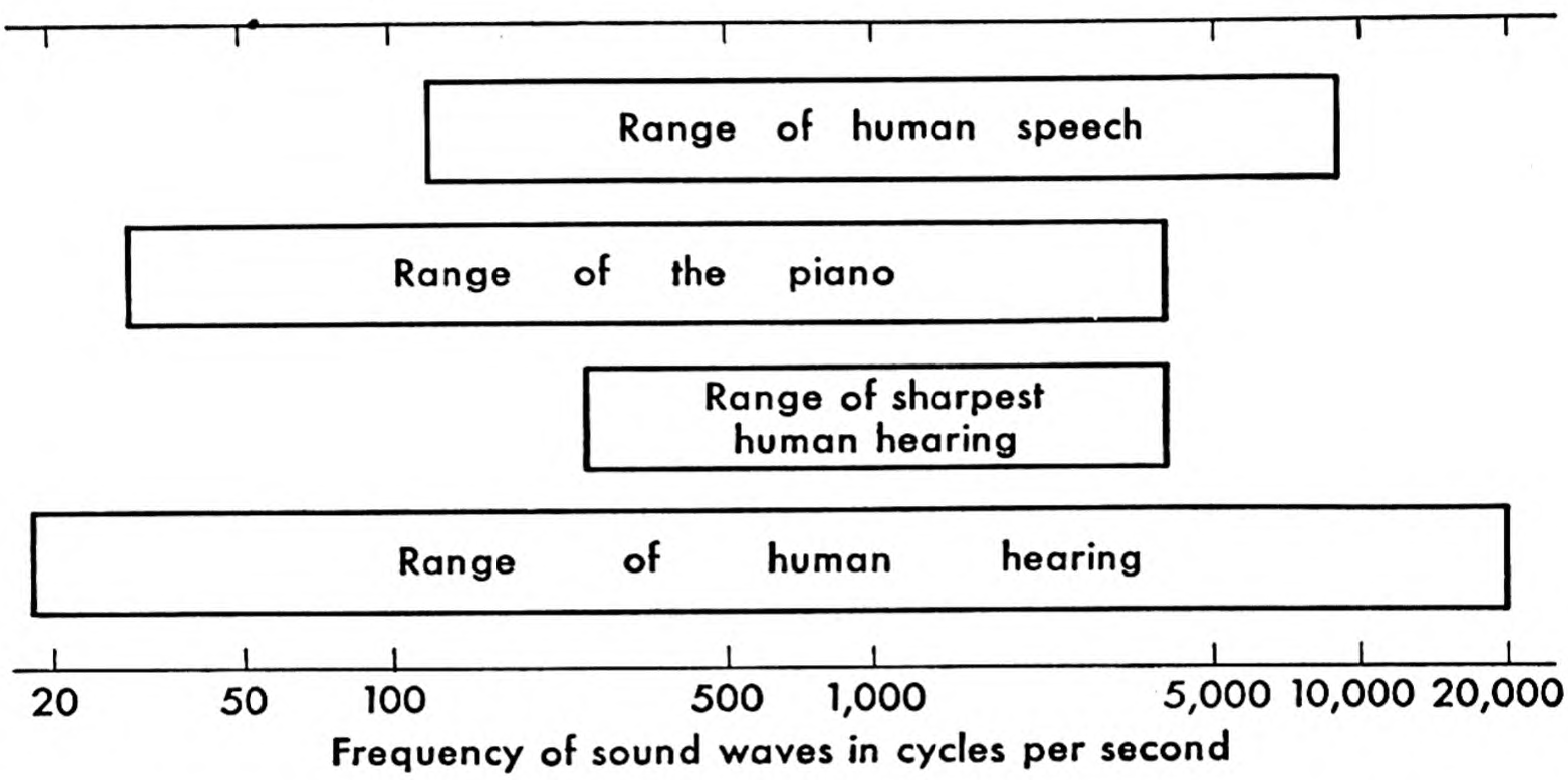


Fig. 28. Some frequency ranges. Healthy young adults can hear sounds over the whole range of frequencies from 20 to 20,000 cycles per second. But they can hear best when the sounds are in the middle range, between about 300 and 4,000. Older people do not hear frequencies above 2,000 unless they are quite loud. The range of frequencies produced by the piano is shown and also the approximate range of ordinary speech.

The relations between the three dimensions of the physical stimulus and the corresponding three dimensions of auditory sensation can be easily remembered by studying the little table on the next page.

| *Variables of the physical stimulus* | *Corresponding variables of the auditory sensation* | *Corresponding variables of the visual sensation* |
|---|---|---|
| Intensity, or amplitude of wave, amount of energy | Loudness of sound | Brightness or brilliance of light[*] |
| Wave length, or frequency of wave....... | Pitch of sound | Hue or color of light |
| Purity of stimulus..................... | Timbre or quality | Saturation |

## VISION

Light is a form of energy that travels through space, celestial as well as terrestrial, at the almost instantaneous speed of 186,000 miles per second. The single function of the eye, with its delicate interlocking apparatus of iris, lens, and muscles (see Fig. 29), is the collection and focusing of these light rays on the sensitive *retina.* It is difficult to comprehend a speed of 186,000 miles per second, but the response of the retina of the eye when a light hits it is equally astonishing. Selig Hecht,[3] a mathematical biophysicist of Columbia University,

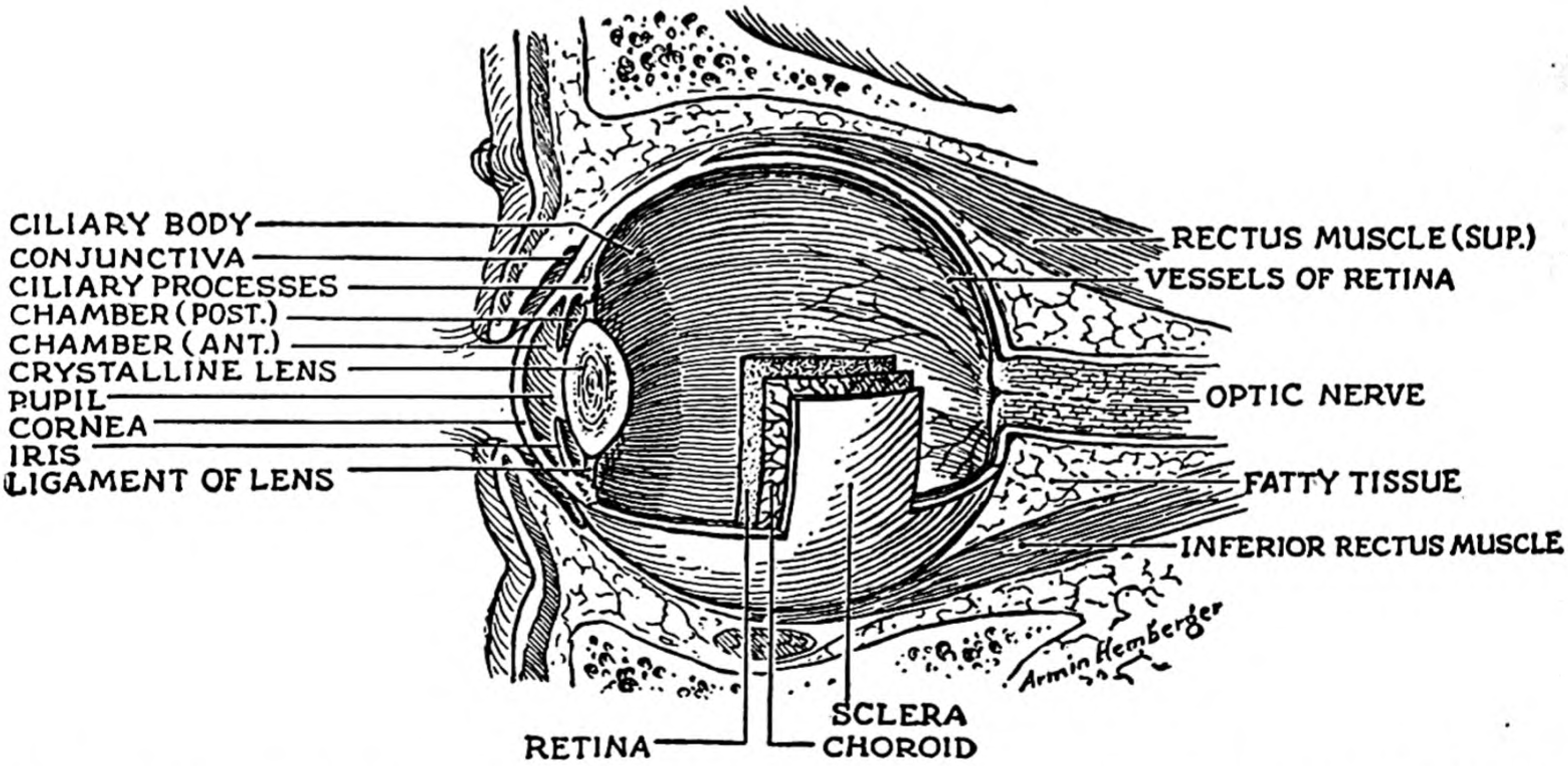


Fig. 29. Human eye. (*From a drawing by Armin Hemberger in G. A. Baitsell, Human biology, McGraw-Hill, 1940. By permission of the author and publisher.*)

has recently computed the amount of visual energy necessary to affect the retina under optimum conditions, taking due account of losses as the light passes through the cornea and the lens. He comes out with the figure of five quanta, a figure that is as staggeringly minute to those who know their quanta as the speed of light is staggeringly great to the rest of us. A quantum is the smallest possible package of light energy, so small that millions of them are necessary to do any noticeable amount of work, like raising the temperature of a fraction of a drop of water a fraction of a degree. In energy units this is in the same range, roughly, as the minute amount of sound energy necessary to affect the ear.

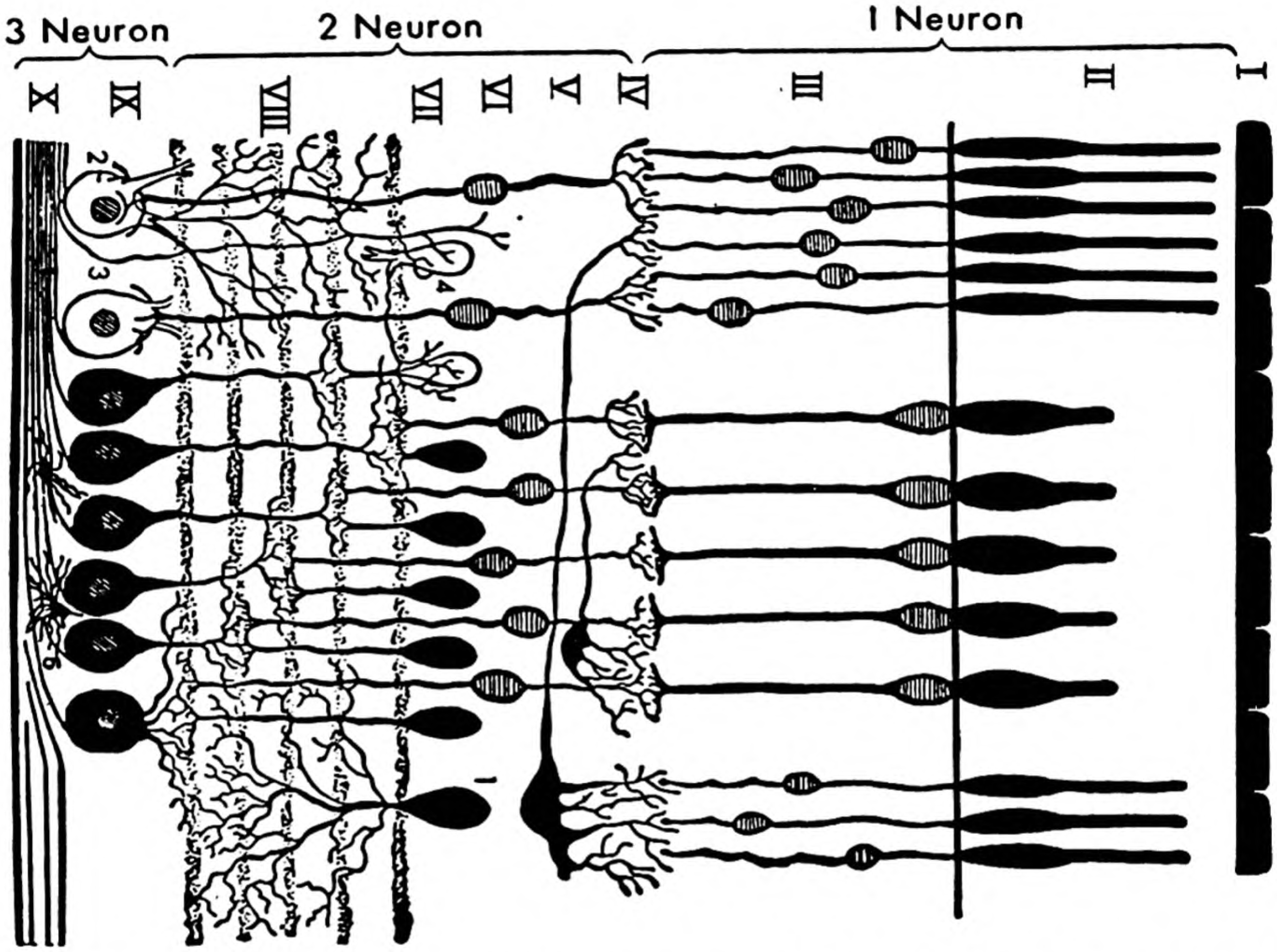


Fig. 30. Diagram of the microscopic structure of the retina. Light enters the eye and hits the retina from the left, passing through several layers of cells to reach layer II, made up of rods and cones. These sensitive cells, when stimulated by light, excite many other cells in layers III to IX, which in turn connect with the nerves in layer X leading out of the eye to the optic nerve and thence to the brain. (*From Howell, Textbook of physiology, Saunders, 1934, p. 371. By permission of the publisher.*)

Although we speak of vision as one sense, we could just as well list two visual senses, rod vision and cone vision, named for the microscopic appearance of the cells in the retina on which they depend.

Usually these two senses overlap and work together, but only the *rods* can respond to very low intensities of illumination (twilight vision), and only the *cones* can respond differentially to lights of different wave lengths (color vision). There are no rods in the exact center of the eye, so, as every ex-aircraft-spotter knows, the best vision of a faint object is attained by sighting to one side of it, letting the light from it hit the retina a little off center. The same off-center sighting is best for analyzing rapidly flickering light into its separate components, so as to pick out the blades of an electric fan or the individual drops in a spray of water.

Lights, like sounds, can be discriminated from each other in three respects. Corresponding to loudness, pitch, and timbre, these are *brightness*, *hue*, and *saturation*. (An interesting difference between light and sound, however, is that sounds give us information about the source of the sound, *i.e.*, the horn, the bell, or the voice, even though it may reach us only after being reflected from walls and ceilings. Lights, from whatever ultimate source, give us information about the object, *i.e.*, the paper, the leaf, or the petal, which reflects the light to us.) A light is seen as bright or brilliant, if the light wave that hits the eye is one of large amplitude or intensity, *i.e.*, if there is a lot of energy behind it. Light waves of low intensity produce faint sensations. Backing away from the source of the light reduces the brightness, in proportion to the square of the distance. The color of the light affects its brightness also, for the eye is more sensitive to yellow, green, and blue lights than to red and violet.

Light travels in waves or pulsations, like sound, but the vibration rate is counted in trillions per second and the distance between one wave and the next is measured in millimicrons. (A millimicron is a thousandth of a micron, while a micron is a thousandth of a millimeter. The lead in a mechanical pencil is about a millimeter in width.) Of all the kinds of energy that are radiating around us most of the time, our eyes are tuned only to those with wave lengths between 400 and 760 millimicrons. The hue of the light, which most people call the "color," depends upon the wave length of the light. The hues and the corresponding wave lengths of most of the visible spectrum are shown in Fig. 31. If the light has a wave length of 680 millimicrons, it will appear as a good clear red. A good orange is seen at

610, and so on, through all the hues of the rainbow, or spectrum, to violet at 430 millimicrons. Sunlight, which is composed of lights of many wave lengths, is seen as white. The intensity of the light has nothing to do with the hue, as long as the light is strong enough to affect the cones.

The cones are located mostly in a rather small area in the center of the retina, so a person with his eyes fixed straight ahead will usually not see the color in an object that enters his field of vision from a wide angle. He can see where it is, and something of its size and shape, but he cannot see its hue until the light from it falls near the center of his retina, or unless the light is very strong. (The experimental-minded student can prove to himself in a minute or two that peripheral vision is usually colorless vision.) Twilight vision, or vision when the light is weak, is also colorless vision, the reason being that the cones are not affected by weak lights. This fact can be demonstrated this evening at dusk or tomorrow morning at dawn. Outlines, and lights and darks, can be seen when the light is dim, but not hues.

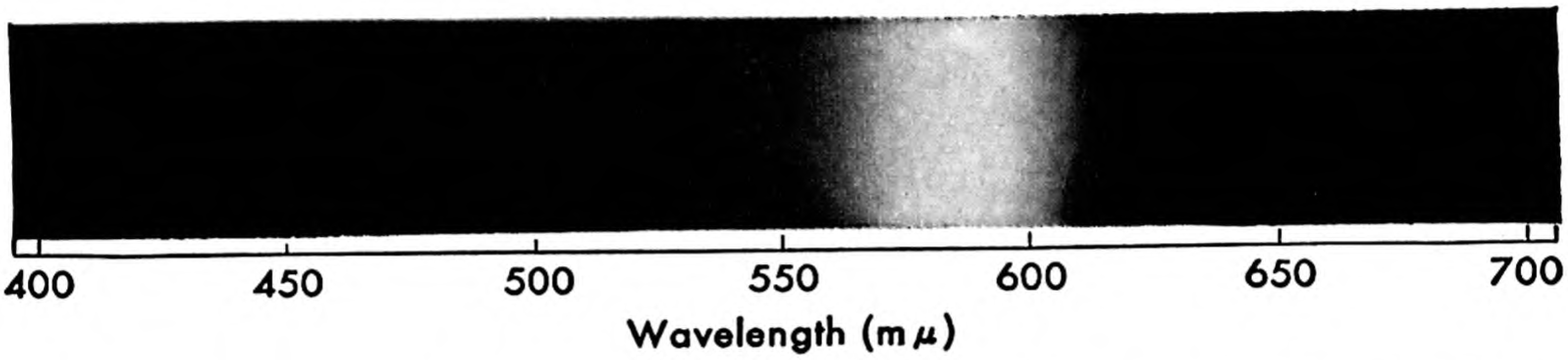


Fig. 31. Spectrum showing the relation between hue and wavelength. (*Figs. 31-34 from Weber, White, and Manning, College technical physics, McGraw-Hill, 1947. By permission.*)

*Saturation* is a technical term for the purity of a light. If the light has a wave length of 680 millimicrons, not contaminated by other wave lengths, it will appear as a good clear saturated red. But, if it is mixed with white light, which contains many other wave lengths, it will be less saturated, even though brighter, and will appear pink. A completely saturated light has no white in it. A light of zero saturation has no hue, but will appear all white, or some shade of gray.

**Color mixture.** Sunlight is composed of lights of many wave lengths combined in such proportions that the whole mixture is seen as white, or colorless. It may be broken up into the separate lights of

different wave lengths when it passes through a glass prism or through the small droplets of water that produce a rainbow. The short wave lengths are bent most in passing through glass and the long ones are bent least, so the whole range of wave lengths is spread out, approximately as in Fig. 31. It is not necessary to use all wave lengths, however. Yellow light and blue light thrown together on a colorless screen will combine to yield a white light. Lights that balance each other in this way are considered *complementary* to each other.

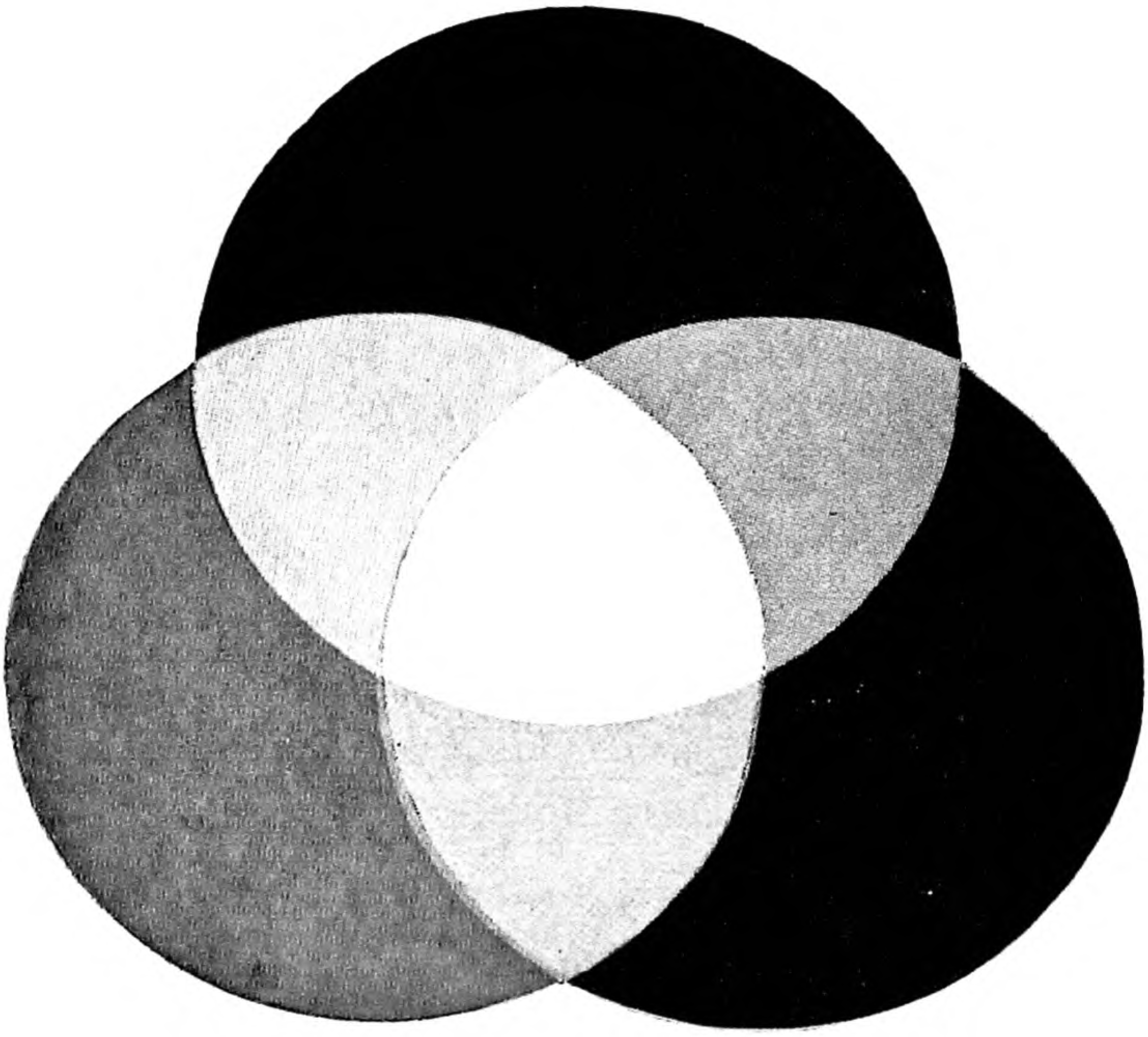


Fig. 32. Additive mixture of colors.

Lights of all colors can be made by mixture of three carefully chosen wave lengths, such as red, green, and blue, in the correct proportions. Figure 32 shows the mixtures that appear when these three lights are beamed on a white screen or sheet of paper. When the light that reaches the eye is a mixture of all three added together, it will appear white. If lights meet the eye in rapid alternation, as when reflected from red, green, and blue segments of a wheel that is rapidly rotating, the result is the same.

*Additive mixtures*, which are produced by lights overlapping on a screen or alternately beamed into the eye, are often confused with

*subtractive mixtures*, which are produced when paints or inks are mixed or when light shines through two or more colored filters. Light reflected from yellow ink on paper, or shining through a yellow filter, will look yellow because most lights are absorbed, and only yellow light and the green and orange, which are near yellow in the spectrum (see Fig. 31), will be reflected. Light reflected from blue ink will be lacking in all but blue, and the green and violet that are near blue. Therefore, when blue and yellow inks, or pigments, overlap, the only light not absorbed in one way or the other is the green. Yellow and blue mixed additively yield white light of higher brightness than either component. The same lights mixed subtractively yield green of lower brightness than either component. For an example of subtractive mixture of the same colors that are mixed additively in Fig. 32, look at Fig. 33 in strong white light.

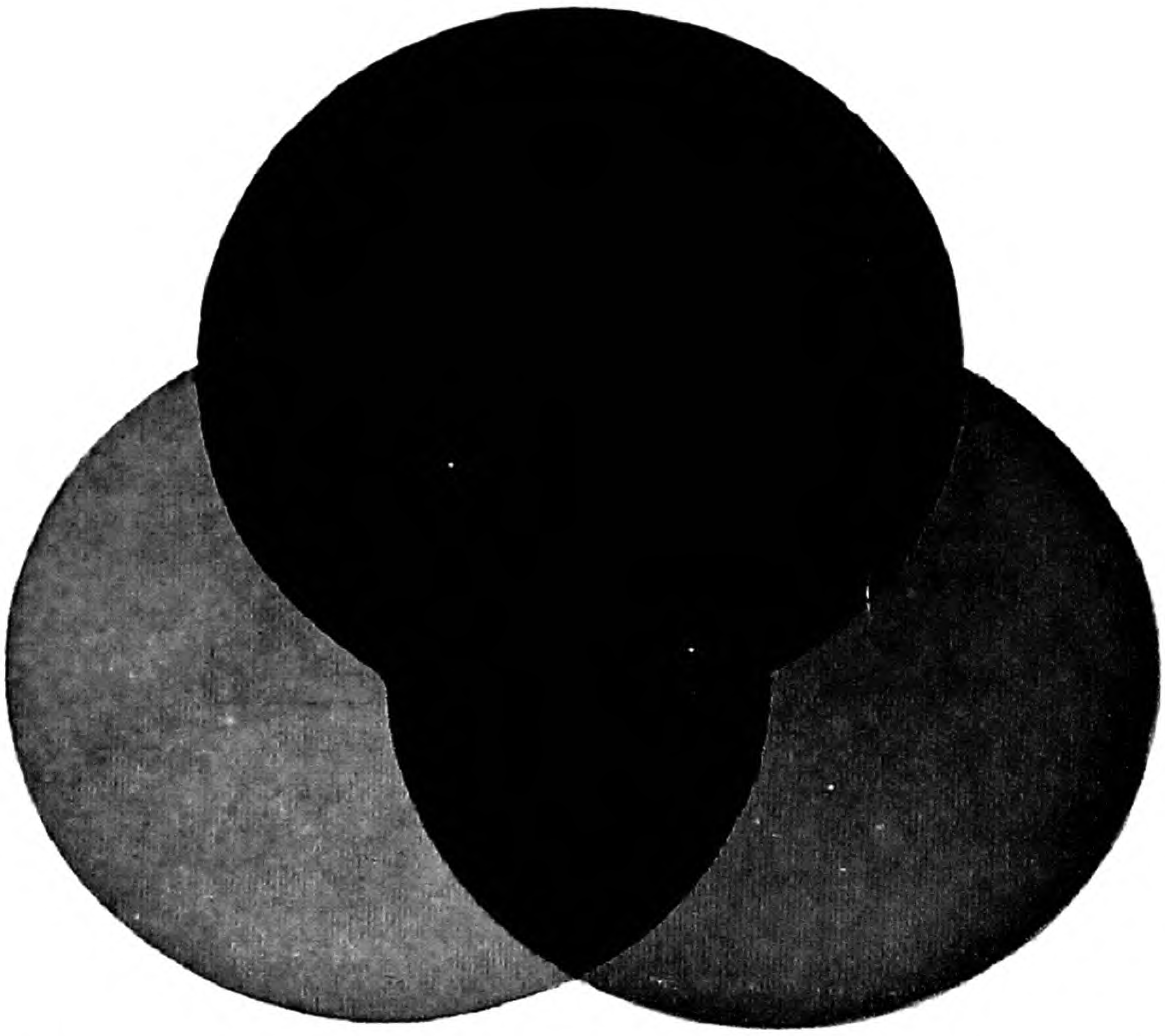


Fig. 33. Subtractive mixture of colors. This picture should be viewed in a strong white light.

Different systems of color photography and color printing make use of additive mixture or subtractive mixture, or both, to obtain a wide range of colors. When the patches of color overlap, the mixture

is subtractive. When they do not overlap but are too close together to be separated by the eye, the mixture is an additive one. Look at Fig. 34 from close range and from a distance of 30 feet.

**Aftereffects.** If you look up into the sky, to follow the flight of an airplane or to catch a fly ball, and happen to look directly at the sun, the effects of such strong visual stimulation will last a few moments after you turn your head away. If you close your eyes, you will still see a bright light, approximately similar to the sun in size and color. This is known as the *positive aftersensation*, or *afterimage*. In order to see the *negative afterimage* you should look steadily at a light of medium intensity for about 30 seconds. A shaded lamp will do or, if you are indoors on a bright day, merely look at a window. Fixate rigidly on some point and hold your gaze there for half a minute. Then close your eyes and wait a few seconds. Most people will report that they see a light of the same shape as the lamp or the window, but of complementary color. That is, what was dark in the stimulus is light in the negative afterimage; what was light is dark. What was yellow may now be blue, but the colors will fluctuate back and forth in a beautiful display. A few people, even with good concentration, seem unable to see any afterimage.

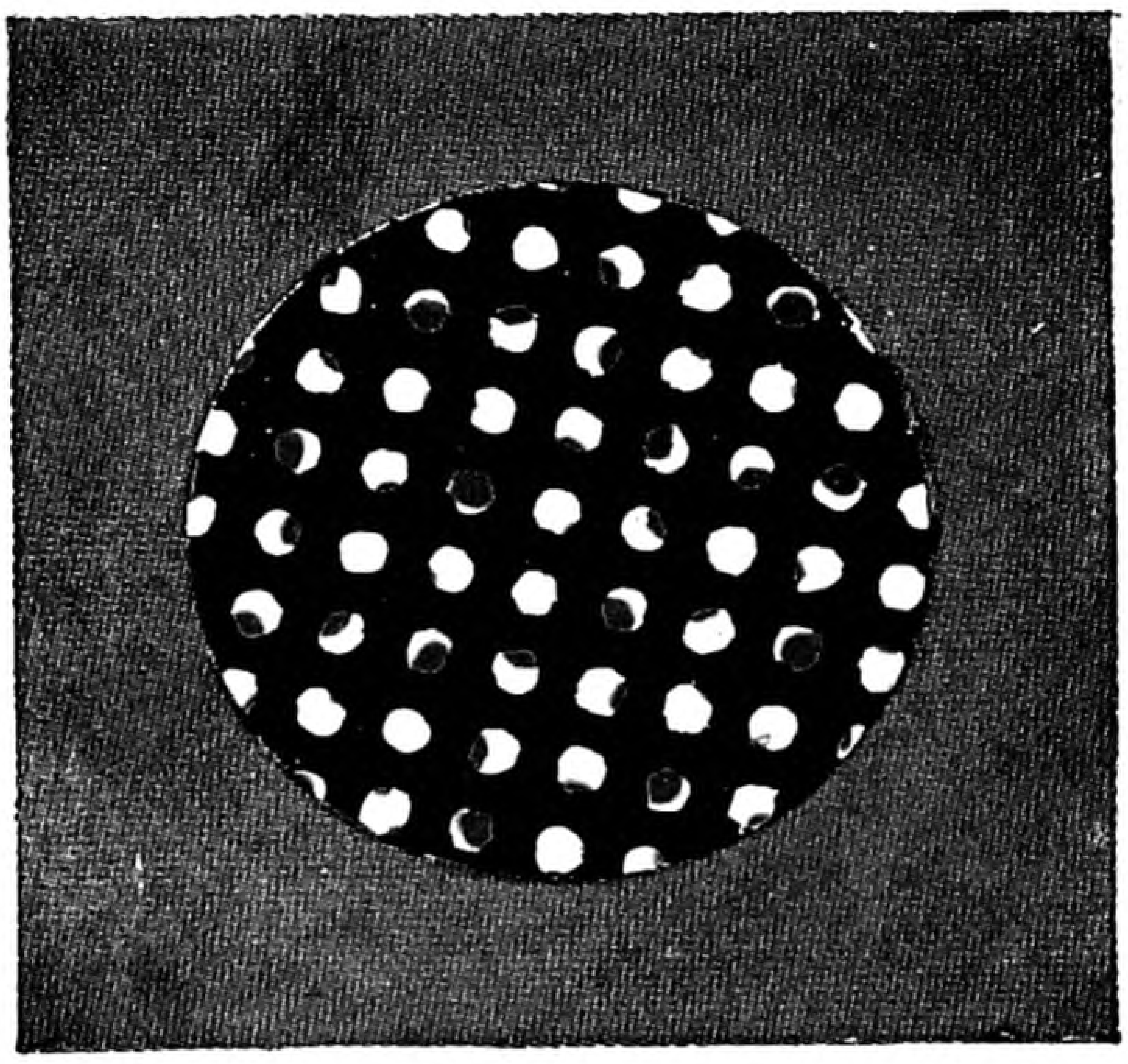


Fig. 34. Microphotograph of a portion of a modern color print, illustrating both additive and subtractive color mixture. Look at it from a distance of one foot and from 30 feet.

The reason for the positive afterimage is simply that the stimulus is so strong that its photochemical effects exceed the recovery rate

of the nerves. The negative afterimage can best be understood by remembering that nerves are living tissue and that the chemistry of the receptors tends to remain in equilibrium. When stimulation pushes the photochemical balance in the eye off equilibrium, it tends to return, and the returning is a stimulus for the complementary colors.

Similar aftereffects can be observed following stimulation by warmth, by cold, and by rotation.

***Visual adaptation.*** One of the remarkable things that the optical apparatus can do is to adapt to a very wide range of illumination. As a person walks indoors, outdoors, in bright sunlight, and in dimly lighted hallways, the light that he must adapt to may be a million times stronger in some situations than in others. And yet, after a little delay, we can adjust to these different degrees of illumination and manage to see quite well in all of them. Several interlocking mechanisms make this astonishing feat possible.

When the light is exceedingly bright, as when strong sunlight shines on snow, we protect our eyes by blinking or squinting. This helps a little. More important is the pupillary reflex, an automatic adjustment of the iris muscles, which makes the pupil of the eye small in bright light and large in dim light. But the bulk of the adaptation takes place in the photochemical processes in the retina itself. *Light adaptation,* which occurs when one moves from a dark room to a brightly lighted one, is quite rapid, being completed in two or three minutes. *Dark adaptation,* as in going out into the night, takes place at a much slower rate. Some improvement goes on even up to 1 hour, although most of it is complete in the first 30 minutes in the dark.

It is possible to cover one eye, keeping it dark-adapted and ready for use in dim illumination, while using the other eye for routine work. Better than that is the use of red light during dark adaptation, one of the practical outcomes of psychological research during the Second World War. The rods, which do the seeing in dim illumination, as at night, are not affected by red light, but the cones are. So if a room is lighted by red light with wave length of about 620 millimicrons, one can see well enough by cone vision for most purposes. But the rods remain dark-adapted, ready for use when the lights are put out or when one has to go out into the dark. Wearing red goggles of the correct construction serves the same purpose,[4] letting enough

red light come through that one can see by cone vision, while preserving the dark adaptation of the rods.

**Optical patterns in space and time.** If we should dissect out a small bit of the retina and examine it carefully under the microscope, we would see that the rods and cones are very close together, so that light falling on the retina from objects in the environment will stimulate, not just one retinal element, but many. Furthermore, there are intermediate nerve cells making cross connections between the rods and cones and different neurones of the optic nerve going back to the brain (see Fig. 30). A result of this interlacing of nervous connections in the retina is that vision is always patterned; stimulation at one point on the retina is always affected by stimulation at other points. The nerves in the brain also are closely connected with many other nerves, so we seldom see minute elementary points of light, but rather patterns of lights and darks. We see objects, contours, or a figure against a background. If the gap between two lights is small enough, we close the gap and see just one light.

We tend to close a gap in time just as we do a gap in space. Most lights used for lighting rooms alternate on and off 60 times a second, but our optical apparatus cannot separate lights that come together so closely, so we see a steady light. Movies, which are a series of instantaneous still pictures, are seen as a smooth, continuously changing pattern of movement, for the same reason.

**Eye movements.** The eye is a pretty busy organ. We are apt to think of the eye as a passive instrument, like the film of a camera, just waiting for light to reach it. It is better, however, to compare the eye to a catcher on a baseball team. It is waiting to receive what is coming, but it is waiting actively, and it adjusts automatically to what has already been received.

The iris, as mentioned above, opens and closes according to the amount of light that reaches the retina. The lens of the eye changes shape when necessary so that the light from the object in view will be sharply focused on the retina. This focusing of the eye is technically called *accommodation.* Since we have two eyes and they must work together for clear vision, there is another set of muscles responsible for *convergence.* Both eyeballs turn in slightly to see an object close to the nose, and turn outward for objects farther away. The eyes, as a pair, also move from side to side and up and down so that, without

moving the head, one can see about 180 degrees in a horizontal direction and a little less than that in a vertical direction. The side-to-side movement is crucial in reading, and fortunately, as we shall see in the next chapter, most eyes can jump along a line of print quite rapidly —more rapidly, if the material is difficult, than the brain can follow.

## INDIVIDUAL DIFFERENCES IN SENSORY FUNCTIONS

All human beings are built according to the same general plan, and, aside from accidents and disease, most people have about the same sensory equipment. One person's motivation may be altogether different from another's, but everyone's hearing is just about the same as everyone else's, except in matters of degree. The chief reason for this is, of course, that the sensory apparatus, being mainly hereditary, is not modified to any extent by experience. People may differ slightly from one another, however, in any of the sensory functions described in this chapter. Individual differences in a few of these functions which are of special importance have been carefully studied by psychologists, geneticists, medical scientists, and even by telephone engineers.

A few years ago a chemist noticed that he could not taste a certain chemical which his coworkers said was very bitter. Geneticists soon became interested in this curious substance, called "phenylthiocarbamide," and proved that one's ability to taste it is inherited in a rather simple way from one's parents. About 31 per cent of the people cannot taste it at all. Of those who can taste it, some have keener sensitivity, or a lower threshold, than others and can detect it in dilute concentrations. About 19 per cent, for example, can taste it in a concentration of 1 part in 320,000, while 1 per cent can detect it only when it is much stronger, 1 in 5,000.[5]

Individual differences in hearing ability are due chiefly to heredity, age, accidents, and disease. Acuity develops rapidly in growing children, reaching the maximum between thirteen and fifteen. The hearing of normal adult men and women as tested by telephone engineers[6] is shown in Fig. 36. A few have very keen ears, a few very poor, but most people are about average. This sort of distribution of ability, according to the normal probability curve (see Chap. 1), occurs when the ability results from many independent factors, such as age,

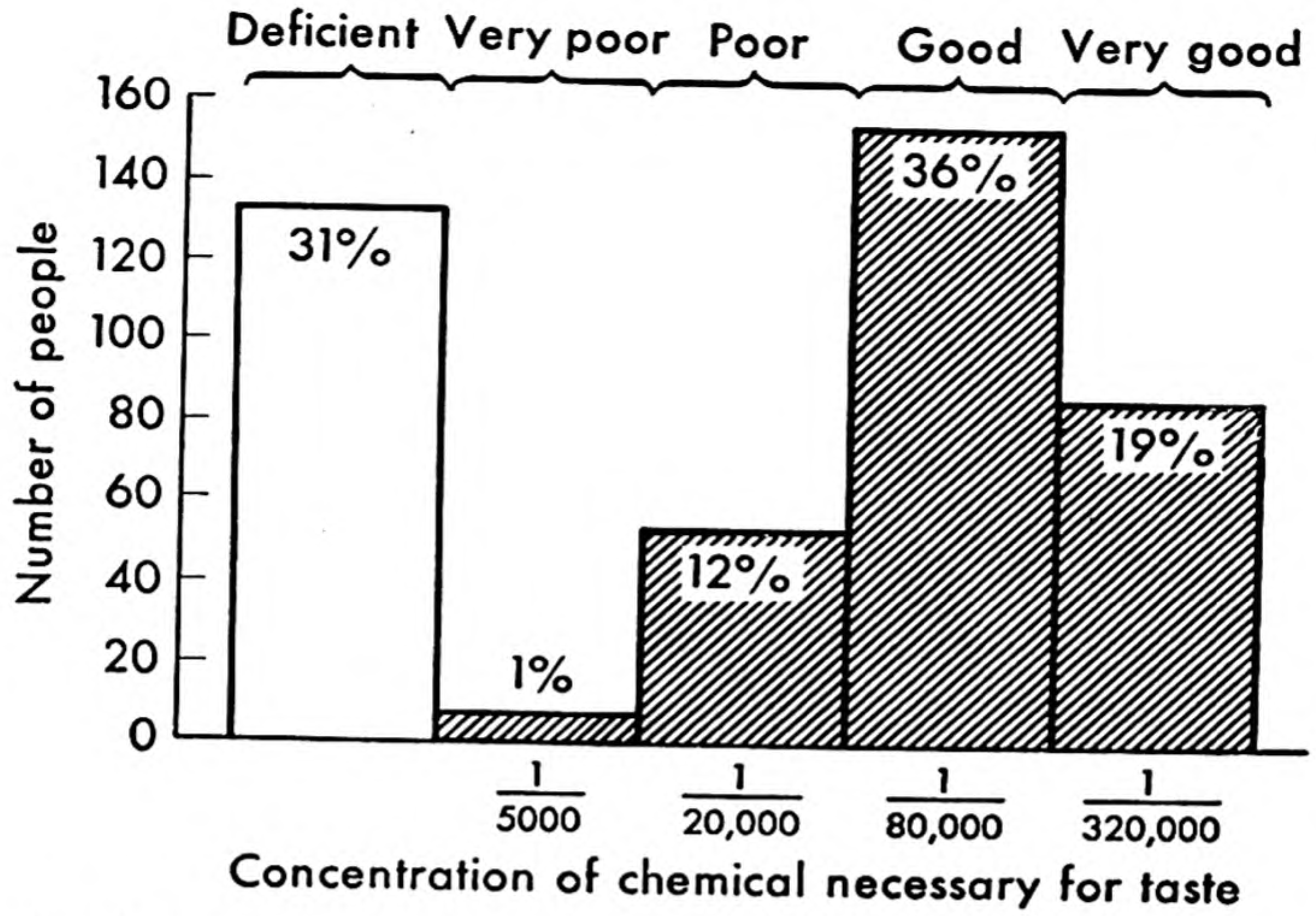


Fig. 35. Distribution of a special gustatory ability. When solutions of a bitter chemical, phenylthiocarbamide, were sipped by 433 people, the bitter taste was not detected at all by 31 per cent. About 1 per cent could detect it only at very high concentration—1 part to 5,000—12 per cent could detect it at high concentration, 36 per cent at medium concentration, and 19 per cent at low concentration—1 part to 320,000. There is a definite division between the tasters and the nontasters. (*Data from Blakeslee.*[5])

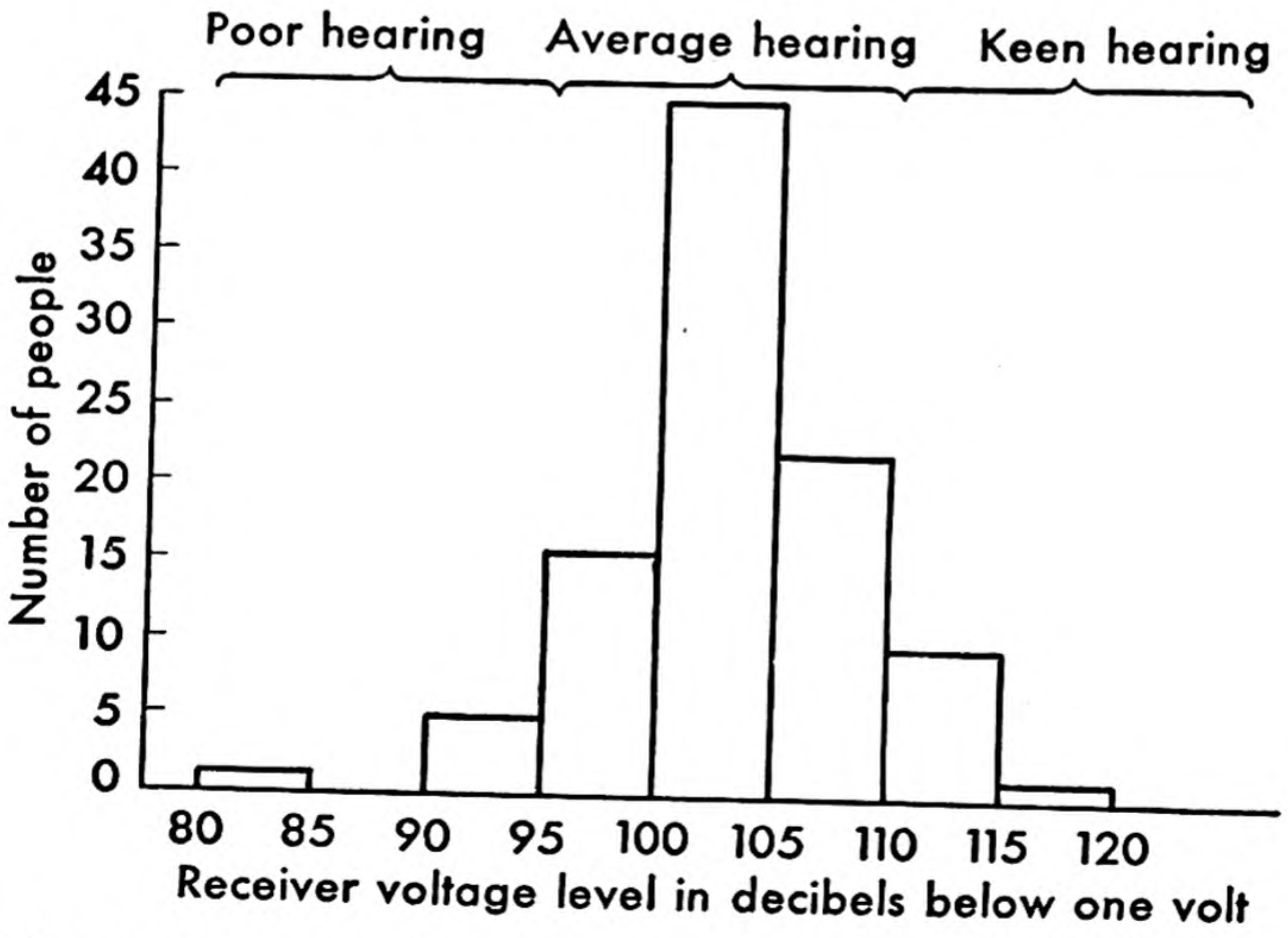


Fig. 36. Individual differences in the hearing ability of 100 people. Voltage level is one way of expressing the absolute threshold. See page 68. (*Data from Steinberg and Munson.*[6])

heredity, childhood illness, and so forth. Contrast Fig. 36 with Fig. 35, which shows two distinct types of taste, produced by a few simple hereditary units.

In order to measure hearing thresholds accurately, very delicate electrical apparatus is necessary. For practical purposes, rough measures of sensitivity can be obtained by the use of phonograph records. The Seashore Measures of Musical Talent, for example, yield rough measures of pitch discrimination, intensity discrimination, and several others. Measurements of hearing loss, necessary for the fitting of a hearing aid, are made with an *audiometer*, an electrical instrument that delivers sounds of standard intensities and frequencies to the listener.

After thirty the ageing of the sense organs and the nervous system produces a decline in hearing ability, which shows up first in a loss of hearing for sounds of high frequency. Young adults can hear sounds up to 20,000 cycles per second, but after forty most of them will be unable to hear frequencies above 12,000. Sensitivity to faint sounds declines with age also. Infections and accidents may lead to partial or total deafness for all or most sounds, but occasionally people exposed to very loud sounds, such as boilermakers, become deaf to only a limited range of frequencies.

Individual differences in vision, as in hearing, are due chiefly to heredity, age, accidents, and disease. Acuity develops rapidly in growing children and declines slowly as the eye loses its youthful flexibility and power of accommodation. Accurate measures of visual discrimination require delicate optical and electrical apparatus and careful experimentation, but for practical purposes, as in fitting glasses, the rough procedures of the usual eye examination serve very well. The distribution of visual ability follows the curve of normal probability, like the distribution of hearing shown in Fig. 36. A few people are very good. A few are very poor. Most people are near the average.

Very few animals can see colors at all. If we include the monkeys and apes, whose vision is the same as man's, the flying birds, some fish, and some insects, we have named practically all of them. The famous bull cannot "see red," unless that phrase is used metaphorically. The percentage of color blindness in human beings is rather high, more than 10 per cent of the male population if mild cases are counted. It is rare in women, a fact which argues for its hereditary origin. Some men are relatively, or even completely, insensitive to red or to green,

or to both red and green. A normal person looking at the world through a reddish lens will see approximately what some red-blind people see. Blindness for yellow or blue is very rare. Many people have mild defects of color vision and never know it until they are given a test. Many red lights have a little yellow in them and many green lights a little blue. The color-blind, like the rest of us, automatically seize any cue they can use in adjusting to their environment; hence a mild defect may pass unnoticed, like a mild degree of astigmatism.

## *SUMMARY: PRINCIPLES OF SENSORY FUNCTION*

All sense organs operate in the same general way. They are particularly sensitive to certain events in the external environment, such as lights and sounds, or to internal events, such as chemical changes. These physical stimuli, if they are within the range to which the sense organ is receptive, stimulate the receptors to send electrical impulses, corresponding in some way to the pattern of stimulation, over the sensory nerves to the spinal cord and brain. Eight senses were described briefly, though there are four skin senses and two visual senses, so the number could be twelve as well as eight.

The animals, including man, discriminate between various aspects of the environment by means of their senses and adjust their behavior, under the influence of the motivation of the moment, to the pertinent things of the world around them. Human beings, who have the power of speech, can in addition describe the sensations produced by external and internal stimulation.

All senses adapt to prolonged stimulation, and all are affected by contrast between a stimulus and its background. Because of the complicated network of neural connections in sense organs and brain, the activities of animals and human beings are influenced by patterns of stimulation, blends of tastes and smells, mixtures of colors and sounds, more than by any single stimulus.

People differ slightly one from another in sensory functions, but except for inability to taste certain chemicals and color blindness, these differences are matters of degree rather than kind. Most of the individual differences in sensory functions are results of heredity, age, accidents, and disease. Sensory functions are not modified in any important way by learning.

## TECHNICAL TERMS FOR SPECIAL STUDY

- discrimination
- sensation
- absolute threshold
- difference threshold
- acuity
- adaptation
- contrast
- kinesthesia
- somesthesia
- loudness
- pitch
- timbre
- overtone
- retina
- rod
- cone
- brightness
- hue
- saturation
- complementary
- additive mixture
- subtractive mixture
- afterimage
- accommodation
- convergence
- audiometer
- color blindness

## NOTES ON TERMINOLOGY

*sense organ* and *receptor:* these terms may be synonymous, but some scientists use sense organ for the whole organ, including such accessory apparatus as eye muscles, and use receptor for the minute specialized neural elements, like rods and cones.

*organic sense:* somesthesia.

*audition:* hearing.

*olfaction:* smell.

*gustation:* taste.

*supersonic:* pertaining to sound waves above the range of frequencies audible to the human ear.

*cutaneous:* pertaining to the skin, *e.g.*, the cutaneous senses.

*tactual:* pertaining to touch.

*taste blindness:* lack of ability to taste certain chemical substances, such as phenylthiocarbamide, sour milk, and quinine.

*limen:* threshold.

# 5

# ATTENTION

When we know what the sense organs do, we know the first part of the story of man's adjustment to his world. Sense organs deliver the raw material of perception to the brain. The next question is how such material is used in this business of life. A live human being, awake, is bombarded by stimuli of all varieties, from objects and people, via all the senses, keeping him informed of affairs of the external world and affairs of the inner man. But, since man's mind is finite, he cannot react to everything at once; he must select certain stimuli and ignore others. This process of concentrating on some events to the neglect of others is called *attention.*

The best way to understand this selective process is to go back to the struggling individual as we left him at the end of Chap. 3, trying to get along in this "burly world of sin," to find food and drink, to win fame and fortune, to protect his skin and his reputation. If we know his dominant motive of the moment, we know what he is most likely to attend to. A person is more likely to notice food, by sight, smell, or sound, when he is hungry than when he is not. Somehow the brain establishes a coordination, or set, which gives stimulation from food a clear track. Just what goes on in the brain during attention is not known, but we do know from recent brain-wave experiments that, when a person looks at something closely or thinks about a problem, the ordinary rhythm of the brain waves is disturbed by a burst of new electrical activity.[1] Similar experiments have demonstrated that the muscles of the body are tense during attention. Furthermore, as anyone can observe for himself, the sense organs are adjusted for best reception—by sniffing, moving head and eyes, and, in some animals, by pricking up the ears. Evidently the organism as a whole is more active when attending to anything. In fact, if a person relaxes completely, as one can with training, he cannot pay attention to anything.

Now this set to attend to a certain class of objects, like food or airplanes, can be prepared in at least four different ways. First, each of the biological drives facilitates attention to the kind of stimuli which satisfy the drive. Or, second, a person can set up such a condition of readiness deliberately, by *voluntary attention,* as when he goes out to look for a four-leaf clover, or when he opens a book and studies persistently in spite of distraction. By voluntary attention we mean a set that takes account of distant goals and ego motivation, self-control as opposed to control by momentary whimsies. Third, one person can induce a condition of attention in another person, either directly, by asking him to attend to something, or indirectly, by suggestion. The fourth way of establishing a set to attend is the persistence of a habit of attending, which has been learned previously. Nearly all motorists, when riding beside the driver, can give an example of this phenomenon. A habit of attending to a class of objects is also called an *interest* in those objects.

The other side of the attention problem is, of course, the stimulating situation. Obviously loud sounds and bright objects are more likely to catch the attention of a passer-by than faint sounds and weak lights. Similarly, sudden loss of support, severe pain, strong odors, an intense nausea, or a blast of cold air all have high attention value. But it is not only the intensity of the stimulus that captures attention, it is also a matter of contrast between the object and its background. Even the fall of a pin to the floor can be an attention-getter in a background of complete silence. A moving object, in which relations with the background are changing, has high attention value. Likewise an intermittent sound, repeated at intervals chosen so that one cannot become adapted to it, and a sound changing in pitch, like an air-raid siren, exert strong attraction to the unprepared senses.

The advertising men and the movie-makers, both knowledgeable apostles of the stimulating life, are the most ingenious practitioners of this phase of psychology. It would pay any interested student to take a few minutes off and leaf through the advertising pages of any magazine with a large circulation. Notice the advertisement that first captures your attention and forces you to stop turning the pages. Then analyze it according to the principles developed in the few paragraphs above. You will see bright colors and strong contrasts, with the impor-

tant objects standing sharply out from their backgrounds. Then notice how your motives and emotions are aroused, once the mechanical features of the layout have attracted your eye. Beautiful girls, steaming food (in winter), cool drinks (in summer), undressed babies, fires, accidents, handsome men, airplanes, animals, and legs are the staples. Patriotic themes come and go, like other topical motifs, in accordance with the advertising men's diagnosis of the trends of the times. The advertiser's next task is to hold your attention while he brings your eye from the lure to his message or trade-mark. This is done mechanically, since the eye tends to follow a straight smooth line, or by force of habit, since the layout artist knows that his readers proceed from left to right and from top to bottom. By force of habit also, many readers follow any comic strip down to the end, where the hero tells all to DRINK ZIZ, FORWARDS AND BACKWARDS, FIVE TIMES DAILY.

The psychological conditions in a movie house are ideal for the control of attention. The house is darkened except for a vivid stimulus at one end. The seats, which are neither comfortable enough to permit complete relaxation nor uncomfortable enough to be distracting, all face toward the screen, thus supplying a sort of social facilitation of attention. The lights are bright and the noise is loud. The shrewd directors highlight the action so skillfully that the eye follows the story effortlessly. Contrast this, if you wish, with the situation in church and you will sympathize with both the clergyman and his easily distracted audience.

The task of one who wishes to hide an object is the opposite of that of the advertiser. He avoids bright lights, loud sounds, and rapid movements if possible, but the fundamental principle of camouflage is the elimination of contrast between the object and its surroundings. *Camoufleurs* on all fronts in the Second World War invented ingenious tricks for this kind of concealment, painting buildings to blend with the color of the neighboring landscape, changing the straight lines and square corners of man-made structures into the irregular contours found in nature, and even making use of indigenous materials in construction.

When a person is trying to attend to something and his attention is drawn involuntarily to something else, the process is called *distraction*, but it is not necessary to examine this process in detail because the

factors, whether personal or environmental, that make an object distracting are the same as those which make it attractive. It is only necessary to add that the distractions are not always effective. One can, by deliberate effort, *i.e.*, by voluntary attention, overcome distractions like poor lighting, noise, boredom, and the lure of delicious gossip in the next room. After careful experimental comparisons of the amount of work done under different conditions, the moral of the story has become clear. Distractions have more effect on motivation than on performance, on the amount one *will* do rather than the amount one *can* do. There are two sequels to this story, however, which are equally significant. (1) Actual measurements of the cost of work in terms of muscle tension and *oxygen consumption* show that, when output is kept high in spite of distraction, the distractions do raise the amount of effort required to get the work done.[2] (2) Under some conditions, one can adjust to a distracting situation so that the effort required decreases.[3] One can get used to almost anything, but the most difficult distractions to combat are those which are similar to the work to be done, *i.e.*, loud sounds when one is trying to tune a violin, bystanders multiplying aloud when one is trying to multiply mentally.

From the biological standpoint, the significance of this process of attention is that it facilitates the organism's adjustment to its environment. The things a person is attending to are perceived more clearly and completely and will be remembered longer. An animal without some such capacity would be like a leaf in a storm, reacting mechanically and indiscriminately to all forces that impinge upon it from all directions. Sustained activity would be impossible in a changing world. Attention has a survival value, then, for any living organism that has to meet its needs by continuous protracted patterns of activity.

## INDIVIDUAL VARIATIONS IN ATTENTION

Since attention is a necessity for perception, learning, and thinking, the *ability to attend* is a fundamental factor in man's progress in this world. Fortunately some aspects of this ability can be measured without difficulty; psychology can boast of a goodly quantity of solid scientific research on this topic. *Span of attention*, for example (also called *span of apprehension*), can be tested, and different people can be compared

with each other in this respect quite easily. Call off these numbers to a friend one at a time and ask him to call them back.

2956
58134
725164
1483962
63971482
947281465
7263419682

Start with four numbers; then, if he gets all those right, go on to five, then six, and so on. To give this test properly you ought to have at least three lists of digits like the one above so that you can allow two or three trials at each level. The span desired is the maximum span, and no one reaches his maximum every time. The average adult will get six or seven right, the average college student can handle eight numbers.

This little stunt is absurdly simple but it has been found to be very useful in tests of intelligence, especially for children and subaverage adults. If a person cannot hold several things in his mind at once, he cannot solve a complex problem that has many elements in it or has to be considered from several angles. And, since this test is both simple and significant, we ought to analyze it further and try to find out what is responsible for a high score, or a low one. In the first place it is voluntary attention that is being tested. The subject being tested knows what is coming and is *set* to grasp all he can of what he hears. Second, memory is involved. One has to grasp the first number and remember it while listening to the others, and he has to remember the last ones while repeating the first ones. In fact, the test is often called a test of *immediate memory span*. It requires a highly organized coordination of the many structures of the ear, of the many different muscles and nerves of the vocal apparatus, but chiefly of the many nervous pathways in the brain that maintain the set. Since all of these parts are alive and therefore fluctuating slightly from moment to moment, it is obvious—particularly to those who recall the discussion of integration and variability in Chap. 1—that one's score on this test will fluctuate from one trial to another and from one day to another.

Furthermore, since this sort of variation results from a complex of independently varying causes, the results will vary according to the law of normal probability. The scores obtained from testing one person 35 times, as represented in Fig. 37, show the same distribution as in pitching pennies: the most frequent scores are near the average, while extremely high and extremely low scores are rare. The same sort of distribution of scores is obtained when 35 different people are tested, one trial for each (see Fig. 38).

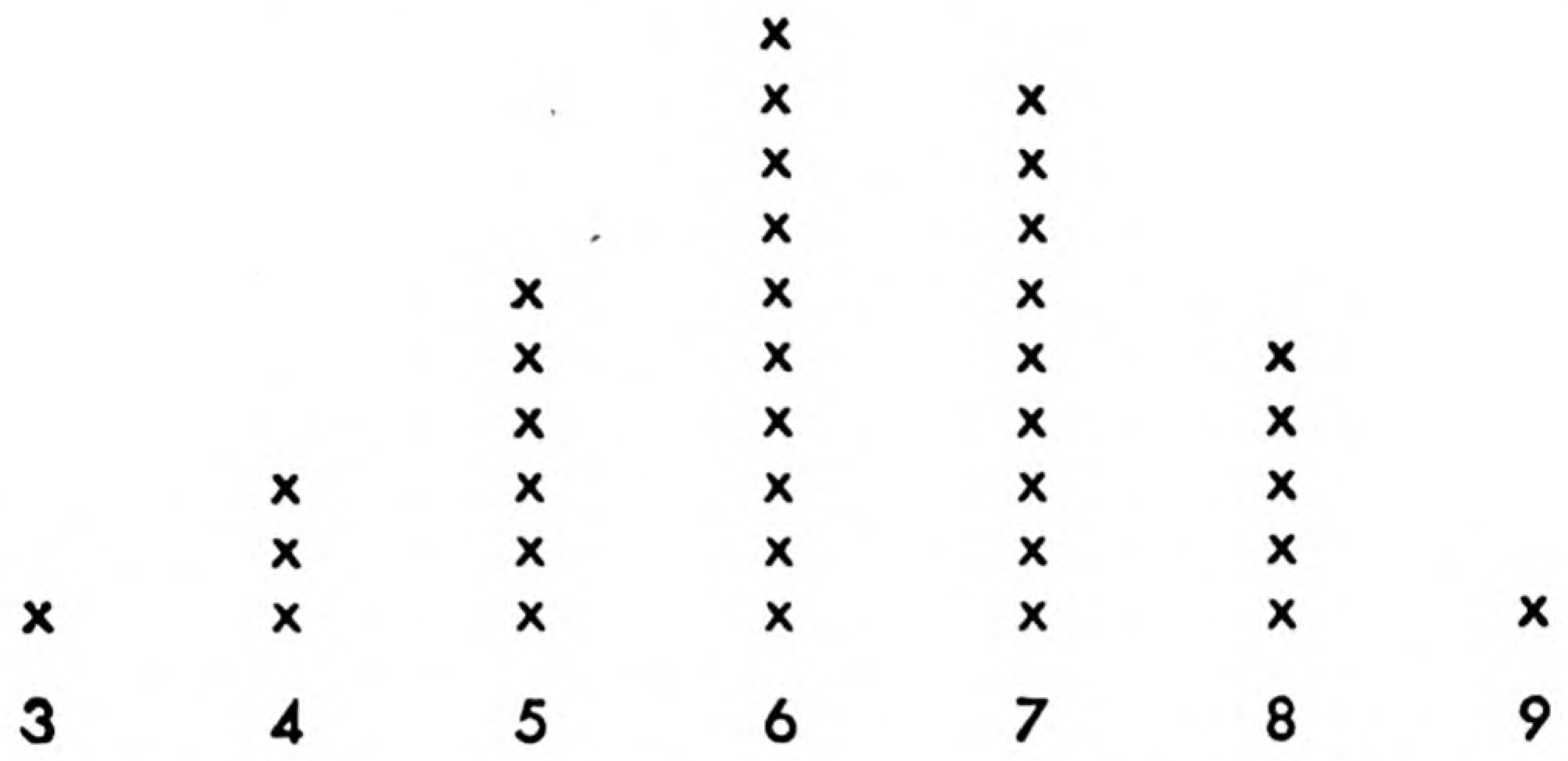


Fig. 37. Distribution of one person's scores on the attention-span test. On 5 trials a day for 7 days the subject made a score of 3 once, a score of 4 three times, 5 six times, and so on.

This is the kind of capacity which is strongly affected by age. David Wechsler,[4] a psychologist of Bellevue Hospital in New York, tested many people of all ages during the process of constructing an intelligence test for adults, and from his research one can see how this ability rises and falls with the ebb and flow of youth. He used the test backward as well as forward. The number of digits a person can grasp, reverse without losing any, and repeat in backward order is one or two less than the forward span, and is an equally useful item in a test of

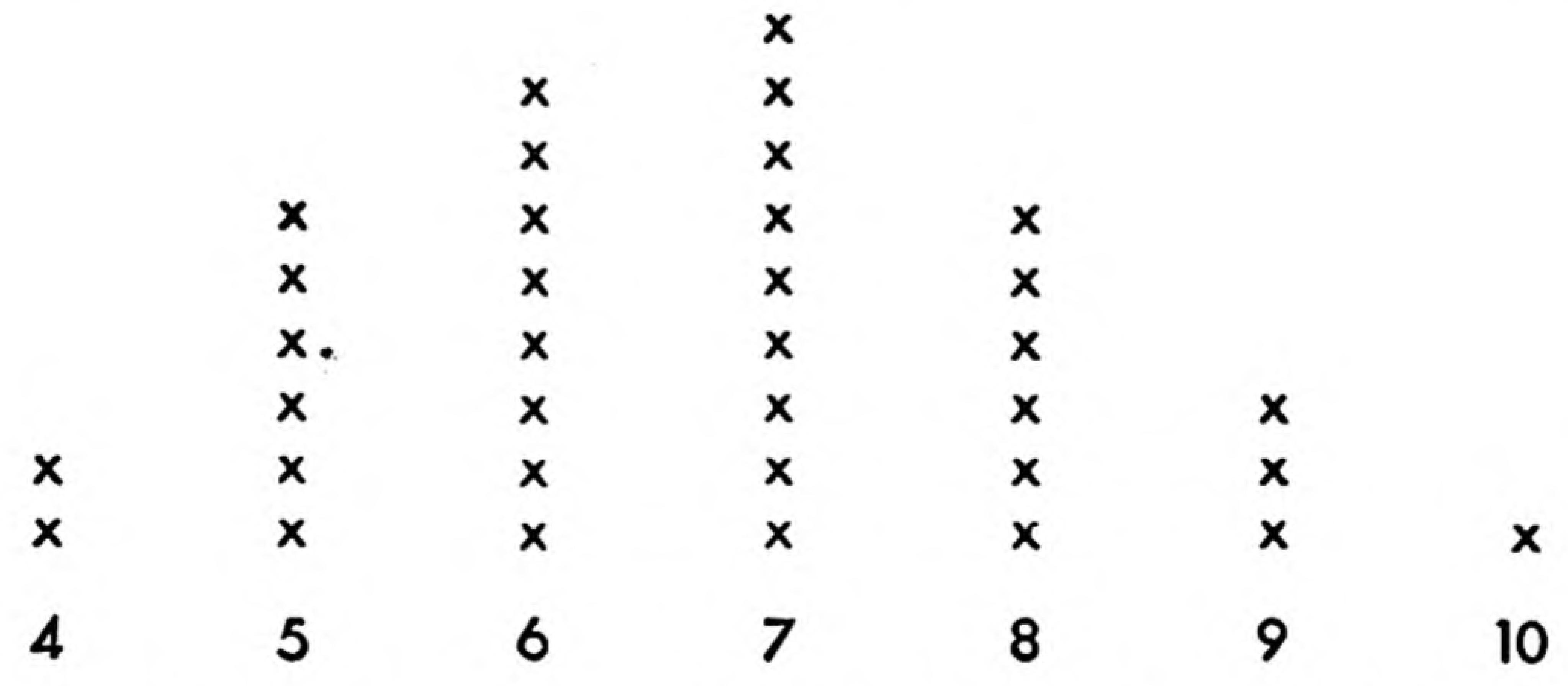


Fig. 38. Distribution of the scores of 35 people on the attention-span test. Only one trial was allowed each person.

general intelligence. Combining the two into one score, as Wechsler does, gives a more reliable score than either one taken separately. The score as he computes it is the sum of the forward and backward spans, two trials for each if necessary. His results, obtained from a cross section of the American white population, show that this ability matures rapidly up to twenty or twenty-five, then gradually declines. Older men of sixty are about as good on the average as youngsters of ten. As we discuss other abilities we shall see that there are many abilities that rise and fall in this way, and a few that show no falling off at all. Attention span also falls off under the influence of alcohol, fatigue, lack of oxygen, as when flying at high altitudes, and as a result of certain kinds of damage to the brain.

Fig. 39. Effects of age on attention span for digits. The score is the sum of the forward and backward spans. The data are averages from Wechsler's standardization of an adult intelligence test and may be taken as representative of the general population. (*Data from Wechsler,*[4] *p. 222.*)

If your friend is still agreeable, try him on letters—using consonants only, so that he cannot make words out of them—and you will note that the span will come out about the same as with numbers.

kmwt
vlftc
hgfjtw
kjyrsml
nbfcvdmy
qxlzdcrfv
plkmgjnwhr

If you change the method of testing, letting him have one quick glance at the numbers or letters, his span will not be much different. The amount one can grasp and hold depends principally on the brain, not on the particular sense organ by which the material is transmitted to the brain.[5] During the years that psychologists have been testing people with tests of this sort, they have found that the span varies with the familiarity of the material and with the possibility of grouping the material into easy combinations (suppose the numbers were 14921776). If the objects to be grasped are geometrical designs, the span is four or five, on the average. It is true, nevertheless, whatever the objects to be grasped or whatever the method of testing, that those who do well on one of these tests of span will do well on the others, with only a few exceptions.[6]

There is more to this process of attention than holding something in mind and then repeating it. In playing a musical instrument, driving a car through traffic, piloting a space ship through the Milky Way, and in many sports, the hard part of the job and the part that produces the errors, is the necessity of shifting attention rapidly from one aspect of the job to another or of doing several things at once. What is required is flexibility or *control of attention*. The tests used to compare people on this ability require them to do several simple things at once, or to alternate rapidly from one thing to another, and are made up so that errors can be counted or, what amounts to the same thing, so that quantity of work done per minute can be ascertained, with a deduction for errors. One such test is the cancellation test, the instructions for which might be: "Go back over this paragraph and mark each *o* with a horizontal line, each *e* with a vertical line." The score is the number of letters correctly marked in two minutes.

Other tests used to measure attentive control are mental multiplication, counting backwards from 99 to 1, following directions, and the like. They are all speed tests, *i.e.*, a high score means many items done in a given period of time. Blocking of attention and letting the mind wander are causes of low scores. These tests are similar in that they all require sustained concentrated effort.

Many sedentary activities such as reading heavy material, studying, making out an income-tax blank, any kind of close work, require, not maximal attention for a short time, but moderate attention over a period

of hours. The critical factor may be one of *interest span* rather than attention span—not how much I can attend to in one burst of effort, but how long I can stay at one task without losing interest, how long I can apply my pants to the seat of the chair. Children fluctuate notoriously in their interests. Kindergarten teachers have to supply them with gaily colored equipment, formerly called toys, and change their activities, even their games, every 20 minutes. This interest span increases as the children mature, but high-school and college students frequently complain that they cannot concentrate, cannot keep their minds on their work. It is a fashionable complaint, like sinus trouble, which psychologists do not take very seriously. Lack of a sense of humor is seldom admitted by anyone, but inability to concentrate is a defect that does not threaten the ego. Hence it is often used to cover up some less superficial trouble.

This is not a success book. Since troubles vary from person to person, and the remedies likewise, the business of a book like this is to build up a general understanding of the normal functioning of psychological processes like attention. Knowing the determinants of attention in general, an intelligent student can attack a problem of concentration systematically, looking first at the motivational factors, then the possibilities of brightening up the stimulating situation, and so on. Usually troubles of concentration turn out to be troubles of motivation. No one has any difficulty addressing himself toward a good dinner or a good movie. The best treatment is to develop an interest in the matter at hand, a difficult but not an impossible task. The habit factor comes into the picture also. Training for concentration, like training for anything else, consists of practice on easy tasks under good conditions, gradually increasing the difficulty of the work and the severity of the distracting conditions. One must be careful, of course, not to proceed so rapidly that the distraction becomes effective, for then the training will make one more distractible, not more attentive.

Some claim that the radio is making the present generation more distractible than their elders, since many teen-agers have the radio on while reading, studying, sleeping, eating, and making love. The case has not been proved, however. What has been proved is that having music on, especially popular music, reduces output in difficult mental

work like studying a complicated paragraph, and this applies to those who say they like to have the radio on as well as to those who do not.[7] On the other hand, in work which does not require complete concentration, like driving a car on the open highway, and many repetitive factory jobs, it can be demonstrated that music maintains the level of attention near the optimum, counteracting the dangerous effects of monotony.[8]

## SUMMARY: PRINCIPLES OF ATTENTION

The sense organs are constantly receiving all kinds of stimulation from the external environment and from within the body. But the organism does not respond indiscriminately to all the forces that play upon it like a cork bobbing on the waves. In normal healthy men and women behavior is integrated; people attend to some stimuli and ignore others. Conditions in the individual that influence the direction of attention are motivating conditions, voluntary control, suggestions from other people, and habit. Factors in the environment of particular importance are intense stimuli, contrast with surroundings, and movement.

When a person is attending to something, the sense organs are adjusted for reception of stimuli from the object of attention, the muscles are tense, and the brain-wave pattern is more complex than when he is not attentive. The object of attention is more clearly perceived than its surroundings and remembered better.

The distracting effects of stimuli that one is voluntarily trying not to attend to can be overcome, but usually greater effort is required.

Ability to attend is related to general intelligence, age, physical condition, and motivation.

## TECHNICAL TERMS FOR SPECIAL STUDY

attention
interest
electroencephalograph
voluntary
distraction
oxygen consumption
attention span
digit span
control of attention
interest span

## NOTE ON TERMINOLOGY

[illegible]

[illegible]

[illegible]

[illegible]

# 6

# PERCEPTION

As intellectual exercise, *perception* has been one of the most absorbing puzzles in the history of man's long attempt to know himself. Philosophers began the attack on this problem, as they did on so many others, but in this scientific twentieth century physiologists, acoustical engineers, neurologists, and mathematical biophysicists all have a hand in the effort, motivated either by an immediate practical question or by pure scientific curiosity. It is not unfair to say, however, that psychology plays the central synthesizing role in this venture, because its subject matter is the *human being perceiving*, while the other disciplines are concerned chiefly with restricted phases of the problem such as the design of a telephone receiver, events occurring in the optic nerve, or a logically defensible theory of knowledge. As the question comes up in psychology, it can be phrased something like this: How are we affected by what we see, and hear, and feel? How do we interpret what goes on around us? How do we use the data from the sense organs in adjusting to our environment? The answer can be stated in very general terms, thus: *The raw material delivered to the brain by the sense organs via the sensory nerves is used and interpreted by the individual in accordance with his past experience and in furtherance of whatever activities he may be engaged in at the moment.* The psychology of perception is an elaboration of this statement, which makes these generalities specific.

## THE IMPORTANCE OF PATTERNS

The first principle of perception is that we tend to perceive patterns of stimulation, not isolated stimuli. Looking out of the window, we do not see strong green lights and faint blue lights, which we then combine into a pattern of trees and sky. We see, and react to, objects, contours,

patterns, figure, and background directly and without any discernible process of combination. Only by stern direction of attention can we pick out the elementary stimuli, which our knowledge of physics tells us are out there. To prove this point psychologists do not trust the evidence of their own observations, and certainly not the observations of other psychologists, for very good reasons. In a subtle matter of this kind subjective evidence is easily influenced by one's technical training and metaphysical presuppositions, to say nothing of ordinary suggestibility. Despairing of finding an intelligent adult who can look out the window with an unprejudiced eye—for the first time, as it were—psychologists have turned to children and lower animals. They train them on two objects A and B (see Fig. 40), of which A is smaller than B, so that the animals will pick the smaller and reject the larger. This is conveniently done by rewarding a choice of A and punishing a choice of B. Then they put before the animals two other objects, A and C, of which A is the same as before and C is smaller than A. Which will be chosen? A choice of A would indicate that the animal is perceiving the same stimulus as before, while a choice of C would indicate that the animal is perceiving a relationship or pattern, specifically, that it is perceiving the smaller of two stimuli. Actually it is C which is usually chosen. Animals and children can be trained to respond either way by suitable rewards and punishments, but it is easier to train them to respond to patterns, especially to actual objects, which are three-dimensional patterns. Furthermore, in estimating shape it is the whole pattern which is used, rather than the separate dimensions, for the error made in comparing two rectangles is no larger than in comparing the heights of both, or the widths, and is certainly smaller than the sum of these two errors.[1]

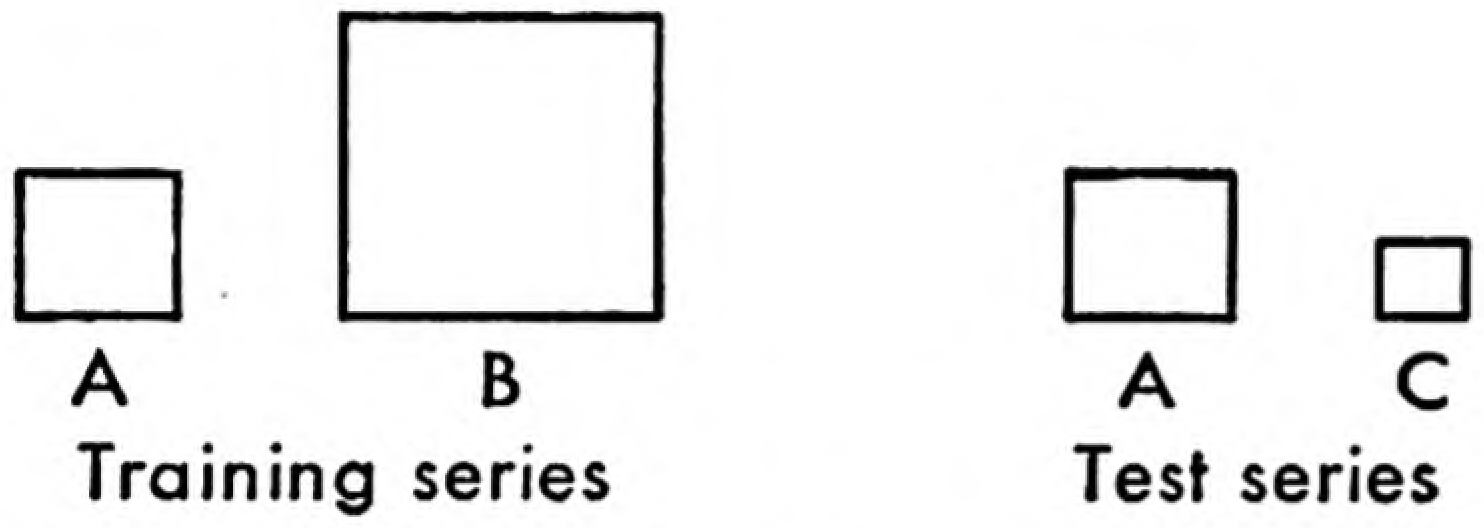


Fig. 40. Stimuli for illustrating the importance of patterns. A laboratory animal, with no particular interest in the psychology of perception, is trained to go to *A* and avoid *B*. Then he is transferred to the test series. Will he choose *A* or *C?*

An even more compelling illustration of the importance of pattern vision is so commonplace that it passes unnoticed in our routine acceptance of the things we perceive. But in the case of a resolute reader who fixes his eyes rigidly on one spot on the page, the light rays re-

flected from all parts of the book, and the edges as well, will enter his eyes and stimulate the thousands of tiny nervous elements in his two retinas. Now suppose he moves his gaze a trifle to the right. Each retinal element will be stimulated now by a different stimulus. Does the reader see thousands of new words, objects, and patterns? Indeed not. Although the stimulation reaching every rod and cone in the eye has now changed, he sees the same book. The total pattern now seen is continuous with the total pattern previously seen. He merely extends the pattern a bit more to the right and subtracts a bit from the left. The overlapping patterns of stimulation are integrated into one complete pattern, a process that takes place partly in the retina itself but chiefly in the brain.

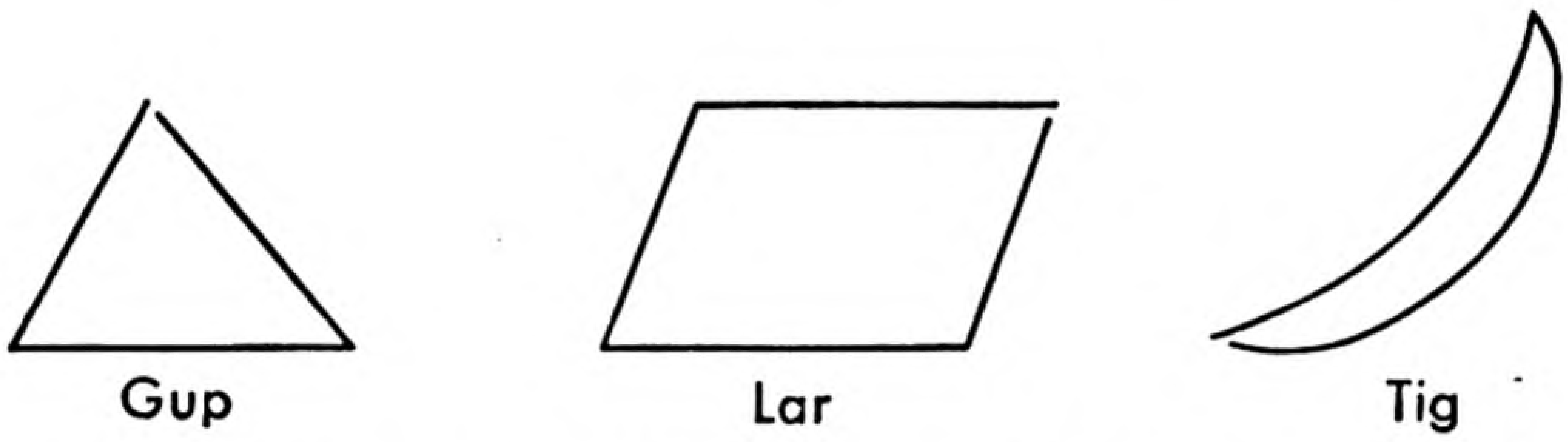


Fig. 41. Show these designs to a friend some dull day; then, a few days later, ask him to draw a Gup or a Lar or a Tig. He will probably close the gaps and draw complete patterns.

Another tendency of the same sort is the tendency to complete gaps, to fill in the patterns. If you show the designs in Fig. 41 to a friend and ask him to remember them, then a day or two later ask him to draw a "Gup" or a "Tig," he will probably close up the designs and draw completed patterns without gaps. This is the explanation of the spectacular illusions obtained by the movies. The common explanation is that the picture changes so fast the eye cannot follow it. But that is only part of the story. What is seen, of course, is one pattern followed closely by an overlapping similar pattern, as in the representation of the falling bomb in Fig. 42. If the gaps between pictures are small enough, *i.e.*, if the pictures are shown fast enough, we fill in these gaps. We see one falling bomb rather than an unorganized and confusing mass of mixed-up lines. If the pictures are exposed so slowly that the gaps (which are space-time gaps) are too large to be filled in, we do not get the illusion of movement. Instead we see each picture separately.

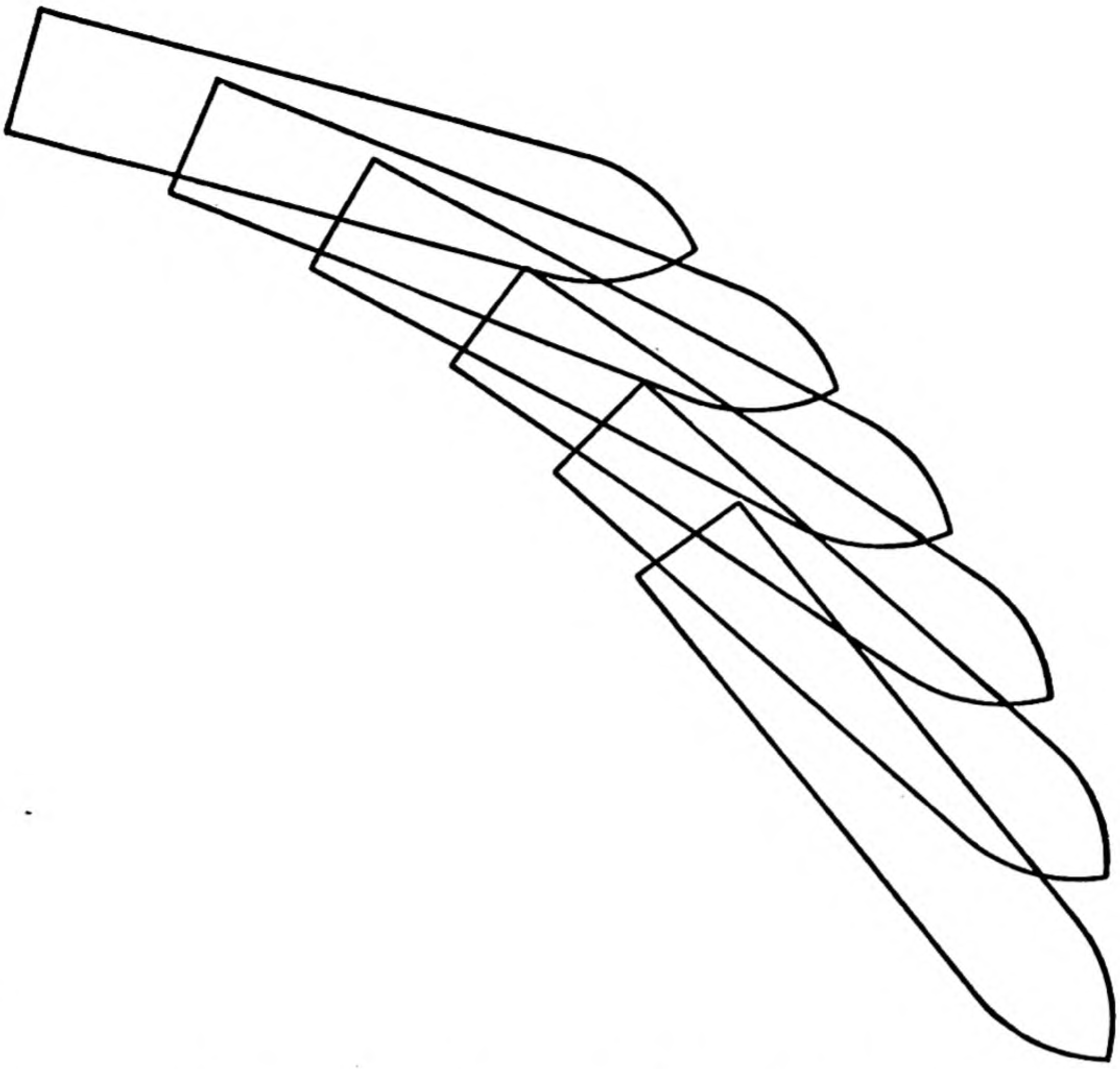


Fig. 42. Falling bomb. Successive pictures of a moving object, as in motion pictures, could be seen as a jumble of mixed-up, overlapping stationary patterns. But according to the principles of perception we should fill in the gaps and see one object in motion. And we do—if the movie is properly made. The gaps may, of course, be too large to be filled in, as in stroboscopic pictures.

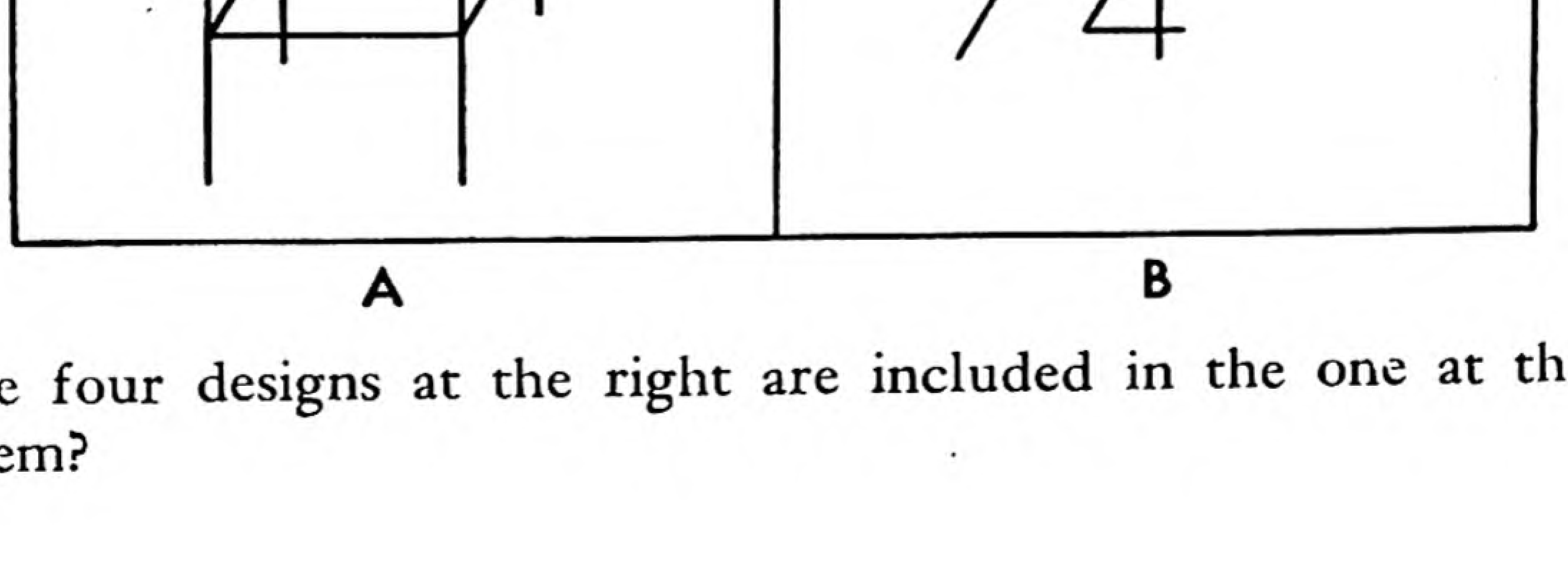


Fig. 43. The four designs at the right are included in the one at the left. Can you find them?

Along with the tendency to see patterns goes the principle that the significance of any part of the pattern is determined by the whole. All the little designs in Fig. 43*B* are included in the total pattern of Fig. 43*A* but the reader will probably agree that they do not look the same. Dogs can be trained to sit up when middle C is sounded on the piano. Play a little melody, however, in which C is included, and the dog will not notice it. Facial expressions are perceived as patterns also in this sense. When we say that a woman has kindly eyes, it is a safe bet that her eyes were seen, not by themselves, but in relation to her whole face. As a matter of fact, eyes are not very expressive. The kindliness is shown by a shake of the head, by movements around the mouth, and no doubt by other gestures, but these, together with the situation in which all this occurred, are combined into a pattern, of which the eyes are a relatively minor part.

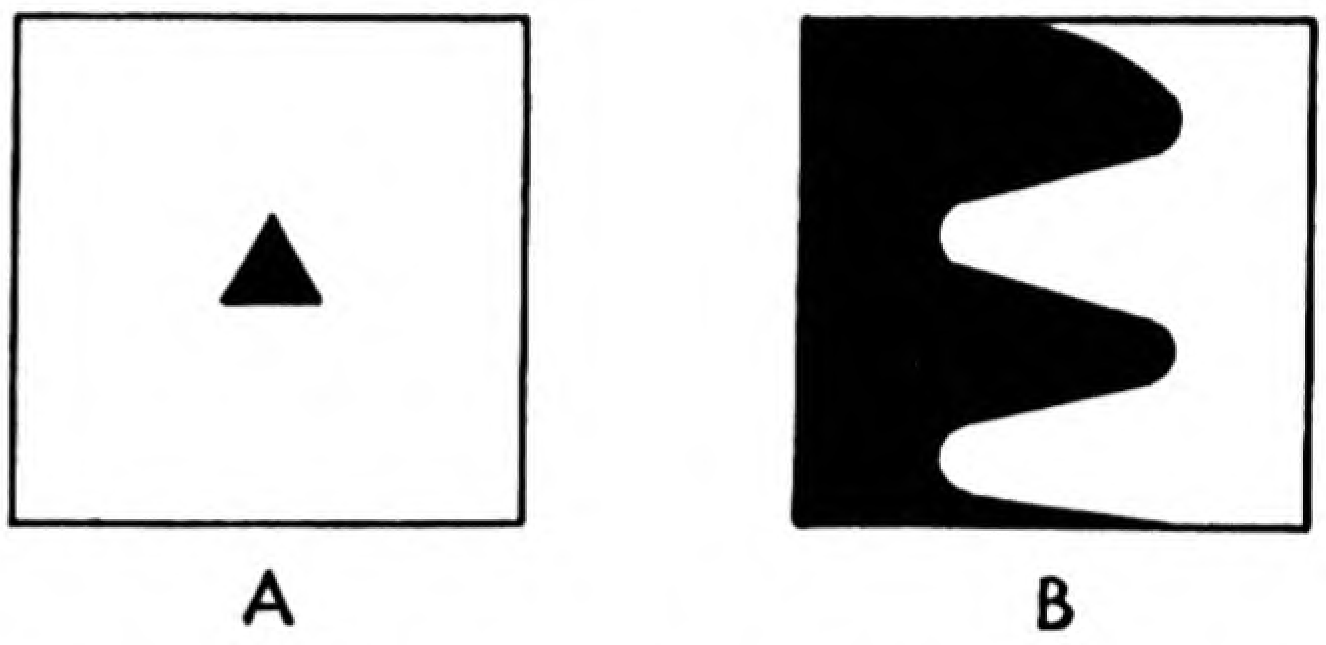


Fig. 44. Figure and ground relations. In *A* the triangle is unequivocally the figure and the white space the background. In *B* either the white space or the black can be perceived as figure and the other as background.

It is settled, then, that in perceiving the world around us the whole has priority over the part. But attention is not equally distributed over the whole field of view. In the perceptual field there is always a part which is perceived sharply, as *figure*, against a vaguely sensed background. Just which part of the field of view is figure and which is *ground* is determined by the objective spatial relations, as in *A* of Fig. 44, where the triangle is unequivocally the figure, or, if the objective situation can be taken either way, by a voluntary direction of attention. In viewing *B* of Fig. 44, for instance, one can deliberately select either the dark half or the light half as figure, the other half automatically becoming background. Riding on a train, one can pass the time quite pleasantly by reversing figure and ground. Looking out the train window and centering on an object nearby fastens this object down, as figure, permitting the trees in the background to move *with the train.* Looking at the faraway trees as figure fastens these objects down so that the objects in the foreground, which is now the background, are seen as moving *backward.*

Edgar Allan Poe has given one of the best illustrations of the sig-

nificance of the background or frame of reference in estimation of size. In his celebrated tale, "The Sphinx," he tells of looking out the window and seeing an extraordinary animal ascending the hillside. Estimating its size by comparison with the large trees it passed he judged it to be far larger than any ship of the line in existence. After describing the ferocious appearance of the monster and his own feelings of horror, Poe changes his focus and discovers that the animal is a minute insect climbing a spider's web along the window sash a short distance from his eye.

The importance of attention has to be emphasized here, because it is the object perceived as figure which makes the strongest impression on the observer and is remembered best. All sorts of illusions can be produced by unnoticed alterations of the background. When one views colored objects in colored light, one takes account of the illumination if possible; hence by concealing the illumination, a white card can be made to take on almost any color. When the color of the illumination is seen, however, one discounts its effect, and the card still looks white. If a person in a large building hears a rumbling sound overhead, he is likely to interpret the noise as something being moved, perhaps a piano or a safe. If he is outdoors and hears a similar noise overhead, he will interpret it as thunder. In neither case is he likely to appreciate the function of his surroundings. He will probably say, quite directly, "I hear thunder," or "I hear something rolling overhead." In Chap. 8, where the psychology of judgment is taken up, the operation of the background, or *frame of reference*, or *context*, will claim our consideration again. In judgment as in perception, the context plays a critical role, but because attention is on the figure rather than the ground, the context or frame of reference is easily overlooked, leaving the way open for illusions and errors of judgment.

## PRINCIPLES OF PERCEPTUAL ORGANIZATION

Granting, then, that the pattern perceived is the important thing, the question immediately arises: What determines the pattern? Why do I hear one pattern of sounds rather than another? Why, if the sensory data can be organized in several configurations, do I see any particular one? In answer to this poser psychologists list several factors of perception, some in the situation being perceived, some in the individual perceiving. The experiments on which these conclusions are

based have included visual, auditory, and tactual perception, but on the printed page it is easier to illustrate the rules of visual perception.

It is necessary, first of all, to analyze the complex perceptual fields of everyday experience into simpler patterns. In walking down the street, avoiding traffic, stepping up and down curbs, and passing through sunny spots into shade, many perceptual principles cooperate to determine what one sees. After patient research on all kinds of situations, psychologists now know how to break down these complex patterns of stimulation without destroying the pattern entirely, and can isolate several principles of *perceptual organization* so that they can be treated one at a time. To begin with a simple standard pattern, consider *A* of Fig. 45. The advantage of this figure for our purpose is that it is meaningless and *ambiguous.* It can be seen as a square or as

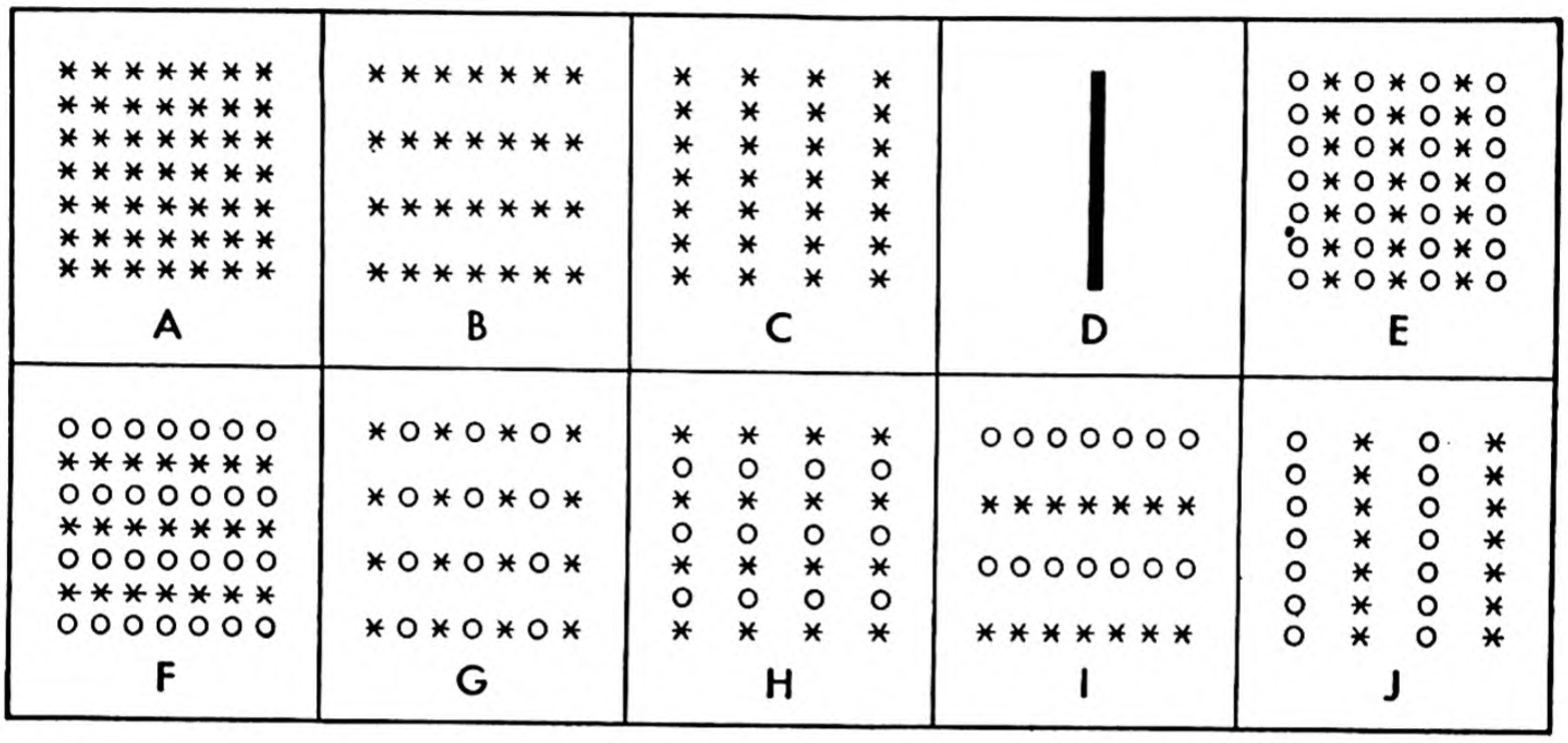


Fig. 45. Patterns to illustrate the effects of distance and similarity on perception. *A* is an ambiguous pattern; it may be perceived as a square, or as seven vertical columns, or as seven horizontal rows. When vertical distances are increased, as in *B,* the pattern is no longer ambiguous; it is clearly perceived as four horizontal rows. When horizontal distances are increased, as in *C,* columns are perceived. When horizontal distances are decreased to practically nothing, as in *D,* only one column is perceived.

The effect of similarity can be demonstrated by replacing some of the stars in *A* with circles. Similars are grouped together, and so we perceive columns in *E* and rows in *F.*

The effects of similarity and distance are combined in *G* and *H* so that they work against each other and the result is ambiguous. In *I* and *J* these factors reinforce each other, so that each pattern is clear-cut.

Assignment: Write a few sentences on the typewriter to show how spacing, capitalization, and punctuation influence perception of patterns of meaning.

seven vertical columns or as seven horizontal rows. If no pattern has the advantage, one will see all three patterns intermittently. But when the pattern is changed a little, the principles governing perception appear quite clearly.

**Distance.** When the vertical distance between the dots is increased, one sees rows, as in *B*. When the horizontal distance is increased, as in *C*, one sees columns. In general the less distance—or time if the stimuli are sounds—between objects the more likely they are to appear as parts of the same pattern. A straight line, as in *D*, is not seen as an assemblage of dots adjacent to each other. When the distance apart is zero, the pattern is compelling.

**Similarity.** Objects that look the same are grouped together. This is shown in *E* and *F*, and it is only necessary to add that, in the conventional scientific way, while the factor of similarity has been varied, the factor of distance has been held constant. The use of color, of course, is a potent method for making things similar or dissimilar.

**Combining similarity and distance.** Lest our analysis go too far, let us put the parts back together again. These two principles can be combined in two ways. In *G* similarity tends to make the columns emerge while distance favors the appearance of rows. In *H* these are reversed. Here we have a conflict of cues, so different people will see different things, and one person will see different things at different times. But it is also possible to combine similarity and distance in such a way that they reinforce each other. This is the more common event in the natural world around us. When this is done, as in *I* and *J*, the effect is clear-cut; the pattern is no longer ambiguous.

**Familiarity.** Other things being equal, we see those patterns which are known to us. To put the same principle in other words, there are habits of perception as well as of action. The expert mechanic listens to the sound of an automobile motor and puts what he hears into familiar patterns, patterns that are different from those heard by the novice. The experienced radiologist, looking at an X-ray picture of his patient's chest, can see all sorts of diagnostic lights and shadings, and he holds profound conversations with his colleagues about these things, while the anxious patient sees merely blurs overlapping other blurs. It is an interesting part of the psychology of learning, the subject of the next chapter, that some perceptual habits are learned very quickly and seldom forgotten. Once a person has seen the face in the puzzle

picture on page 197, his perceptual organization of the picture is rather firmly fixed. Any other patterns that might be constructed out of the picture are likely to be forgotten, while, as in other kinds of learning, the most satisfactory pattern is retained. The zoologist, looking at a number of animals, will group similars together and will therefore see ungulates, echinoderms, and insects, while the hunter, by the same process, will see edible and inedible targets, fair game and fowl. The observer's training, the names and classifications he has in his repertoire, chart the latitudes and longitudes of his perceptions.

**Set or preparation for perceiving.** Perception is an active process. No animal worth his salt, and certainly no human animal, spends much of his time passively waiting for the prod of environmental stimulation, like a photographic plate biding its time in a dark camera until it is exposed to the bright lights of the external world, which it can then register as an objective record of reality. One's interests, desires, fears, and prejudices have a voice in the matter, and because these dynamic factors influence the sensitivity of the individual to environmental stimuli, the process of attention has been analyzed in the preceding section. But these motivating factors do more than facilitate the responsiveness of the sense organs and the nervous system to external stimuli; they slant the perceptual system toward certain predetermined ways of interpreting and acting upon the material transmitted by the sense organs. If a man is thirsty enough, not only will he be able to smell water more quickly than usual, but, if the pattern of odors that reaches his nostrils is not clear-cut, he will be likely to smell water whether any is present or not.

The influence of motivation on perception is nothing that has been recently discovered in a psychological laboratory. Novelists, dramatists, and even comic-strip artists have made good use of the hallucinations of the famished and the conscience-stricken. But psychologists, who are always a little skeptical of literary emotions anyway, have succeeded in bringing this phenomenon into the laboratory, even though in only a diluted form and have put their statistical seal of acceptance upon it. The technique is simple. They use ink blots, similar to the one in Fig. 46, and ask people what they see in them. Ink blots are deliberately chosen because, in these, such factors as distance and similarity are ambiguous. The interpretation of an ink blot, like any other psychological activity, is the end result of many contributing

factors; hence, by minimizing such objective factors as distance and similarity, the personal dynamic factors in the individual, such as sets, are emphasized. This is just what happens, for people looking at the ink blots before a meal report seeing more food than their well-fed companions.[2] And, just to make the proof more convincing, the longer people go without food, the more food they see in, or project into, the ink blots.[3]

Fig. 46. What do you see in this ink blot?

The mechanism behind this phenomenon is the set or lay of the brain, established by the hunger drive, which channels and organizes the incoming nervous impulses from the sense organs. Similar sets are prepared by suggestion and by a deliberate intention to perceive, as when a person lying on his back in the afternoon sun consciously tries to make the passing clouds look like the coastline of Alaska. Likewise, when a sprinter is in his holes waiting for the starter's gun, his perceptual apparatus is thoroughly prepared for the sound of the shot. He is set. Because the nerve pathways of the brain and spinal cord are arranged beforehand, the sensory impulses from the ear along the auditory nerve find a pathway open for them, and they automatically release the coiled energy of the tense muscles. There is no deliberation:

"Is this noise a shot or is it not?" Any sound that is at all like a gunshot will be heard as one and will start a runner who is thoroughly set to go.

***Perceptual attitudes.*** These illustrations show rather bluntly that such activities as seeking food or water and waiting for a starter's gun make a difference in what one sees and hears and smells. Other enterprises in which a person may be engaged govern his attitude toward, and utilization of, sensory data in more subtle ways. If he undertakes to inventory what he perceives, his approach will emphasize completeness, taking in everything in a noncommittal fashion. If he is interested in his environment only to the extent of traversing it, he will so organize the raw sensory material that he will see paths, distances, and obstacles. Or his approach may take the form of classifying, grouping, discriminating, naming, or evaluating. What seems like a straightforward, objective perceptual attitude, asking simply, "What do I really see?" actually is a very rare and highly sophisticated attitude. Some artists train themselves to this objective attitude but basically they are more interested in the problem of representing what they see in a three-dimensional world on a two-dimensional canvas. Perhaps it is possible for some rare intellect who walks on the earth like a natural man to achieve this refined attitude, but it is an extremely artificial feat, which bears little relation to the mundane projects of ordinary mortals.

In tests and experiments dealing with sensory processes, the subject's attitude is one of the most important independent variables, and different subjects looking at the same stimulus situation with different attitudes will give different experimental results. Psychologists used to try to control this perceptual variable and get evidence on sensory processes by training their subjects to ignore the meaning or use of the objects perceived and report exactly what they see or hear or feel. This was the method of classical *introspection*. It is very difficult to do, and since the results have not been clear-cut, the method has been largely abandoned except for preliminary work. The modern procedure is to set up the situation so that the subject has to discriminate between two stimuli, such as lights of different intensities or sounds of different frequencies. Or the subject may be shown several stimulus objects and asked to match the two that appear most similar. Then the subject's attitude will be fairly well standardized and, if other independent variables are well controlled, the results will give accurate evidence on

sensory processes under standard optimal perceptual conditions. Most of the modern data on sensory functions, as presented in Chap. 4, are obtained in this way, either by the *discrimination method* or the *matching method.*

### BIOLOGICAL AND SOCIAL UTILITY

By way of bringing together these principles of perception, let us first consider their biological significance, *i.e.*, their survival value. Perception is the process by which living animals find what they want among the flora and fauna on the earth's surface and detect the presence of danger. A perceptual system that can apprehend the pattern of a tree and hold onto that pattern even when, as the tree is approached and passed, the pattern of visual energy reaching the eye is continuously changing, has a much greater survival value to the animal than a system, like a man-made electric eye, that responds always and pedantically to the same variation in the incident light. There is survival value also in a perceptual mechanism that is tuned up and guided by the driving force of bodily needs and fears. As we fill in these broad outlines, we shall see that these mechanisms, like all other natural functions, are not perfect. They make possible the adjustment of the animal to its natural environment most of the time, but they do not guarantee that this adjustment will be without flaw. For perception is not—the point should be reemphasized—a passive transcription into consciousness of the physical energy to which the sense organs are sensitive. Under certain artificial conditions it may be just that. But under many other conditions the perceptual mechanisms form conflicting patterns, the perceiver is confused, and the activity of the moment is impeded. When this happens, as when the source of a threatening sound cannot be localized or when an object is seen in one place but felt in another, the perceiver tries first one pattern of the data then another, until he can integrate an inclusive perception that does not interfere with his progress. What he perceives, then, is the resultant of many different factors, some in the external situation and some within himself, some conscious and some unconscious, all of which add their contribution in some measure to the final result and any of which may, when conditions are right, play the dominant role. When the inner guilt feeling is strong enough, as in the hallucinated paranoid, one may hear accus-

ing voices—regardless of the objective situation. For normal individuals "in contact with reality," as the psychiatrists say, the objective situation usually outweighs the inner motivations, unless the objective situation is ambiguous. All these principles can be made more specific in their operation by considering a few illustrations of typical problems which the perceptual mechanism encounters during its 24-hour tour of duty.

## PERCEPTION OF SPACE

**Localization.** Keeping the organism informed of the location of objects around it, an essential occupation of the perceptual apparatus, is carried out in several ways, with the aid of several sense organs. An object in contact with the skin, for example, may be located either by tactual perception or by visual perception. Naturally any wide-awake person uses whatever information serves his purpose best. With eyes closed most people—and the blind have no unusual ability in this line—can point to an object touching their cheek with an average error of only a quarter of an inch. Errors in locating a stimulus on the back are much larger. It is interesting to note that, for most animals, the brain is not necessary for this function. A dog with his brain separated from his spinal cord can scratch the point stimulated quite well, and if one leg is held down, he will scratch the right place with the other. Connections between sensory nerves from the sense organs and motor nerves to the muscles are made in the spinal cord as well as the brain, and some of these lower coordinations are sufficient for simple activities. Human beings can do similar simple things when asleep.

**The ear as a direction finder.** For locating the position of objects at a distance, the ears and eyes usually cooperate, but it is easy to eliminate either and study the function of the other by itself. When a person cannot see the source of a sound, he can still localize it moderately well by hearing alone if he has two good ears. Plugging one ear and then walking down a busy street will convince anyone of the necessity of two ears for good auditory localization. For the only good cue anyone has in locating the source of a sound is the fact that the sound is different when it arrives at one ear than when it arrives at the other. If a sound originates anywhere to the right of a listener, it will arrive sooner and it will be louder at his right ear than at his left. Since the sounds are actually different at the two ears, it is conceiv-

able that two distinct sounds would be heard, one at the right and one at the left. But we know from our study of the principles of perception that the nervous system tends to put elementary stimuli together into patterns, and that is just what happens in this case. Somehow the brain combines the information, gathered separately by the two ears, into one unified perception of the direction from which the sound came.

There are limitations, however, inherent in the very nature of this arrangement. A sound originating from a point straight in front of the listener is, under most conditions, indistinguishable from a sound directly in back, or overhead. It will be practically the same at the two ears in all respects. A sound that is a little to the right of the middle will be a little different at the two ears, and will be perceived as a little to the right of the mid-line, but when the listener is asked to point to it, he may point a little to the right of a line directly behind him, or above him. The right-left direction of the sound can be perceived very well, but there is no mechanism for accurate perception of the up-down and front-back directions.

It certainly would be convenient to have another ear, located perhaps on the top of the head. Mechanical direction finders for locating submarines, land mines, oil deposits, and airplanes have three receivers for just this reason. The next best thing, for people with only two ears, and especially for those with only one good ear, is to move the head from side to side or to walk back and forth, thus getting a bearing on the sound from several angles.

To investigate this matter of localizing sounds and to work out the principles that are stated here, careful control of environmental conditions is required. Often the experiment is done out in an open meadow or on a roof so that there will be no reflected sounds to confuse the listener. In ordinary rooms and even in the street, sounds are reflected from walls and other objects so the up-down and front-back directions can be appreciated to a slight extent. To go further in the analysis of the *time difference* and the *intensity difference* at the two ears, it is necessary to generate artificial sounds and lead them to the two ears independently. The sounds are manufactured electrically in one room and conducted over separate wires to separate headphones on a listener in another room. Thus the experimenter can give his subject two sounds with no intensity difference and any time

difference he chooses, or no time difference and any intensity difference he chooses. It turns out from this kind of research that either a difference in time of arrival at the two ears or a difference in loudness at the two ears is sufficient by itself for localization in the right-left direction, but that the time difference is the more potent cue for localization of sounds of low frequency, while the intensity difference is the more potent for sounds of high frequency.[4] Since the sounds used by bats in avoiding obstacles in night-flying are of very high frequency, 50,000 cycles per second or so (see page 74), it is likely that they use the intensity difference almost exclusively. These high-frequency sounds have very short wave lengths; they do not bend around the head as the long wave lengths do, hence their effect is more clear-cut, quite similar as a matter of fact to the effect of light waves.

When these facts were first discovered, they caused some consternation in scientific circles because the time difference at the two ears is so minute. Knowing that sound travels at the rate of 1,130 feet per second, anyone with a little patience can soon figure out that the time taken to reach the far ear will be only slightly more than the time taken to reach the near ear. In fact when the sound is straight out at one side, the time difference, for any head that will fit into a ready-made hat, is only about 0.0007 second. When the sound is 3 degrees off from the mid-line, which is about the smallest angle that can be detected, the time difference is only about 0.00003 second. The scientists would not believe any human being could be affected by such a small difference and hastened to check their apparatus—for if there is anything a scientist is afraid of, it is that a slight error in his apparatus will permit him to say something he will later be ashamed of. But the facts held up.[5]

***The eyes as range finders.*** When we can use our eyes, localization of objects is very accurate, in the right-left and up-down directions at least, because the light waves are funneled through a little hole in each eye, the iris, to be spread out on the retina in back of the eye just as they would be on the film in a camera (see Fig. 29). The puzzle is the near-far direction. How does an observer gazing out the window know that the window is close to him while the trees are far away, and that the clouds are farther away yet? That is the question, which will not interfere with the sleep of the average col-

lege student, who is willing to take the trees and the clouds as he finds them, but *depth perception*, or the perception of the third dimension, is a critical matter for aviators, landscape painters, and center fielders. Leonardo da Vinci worked out some of the answers to this question in the fifteenth century, then turned around and used this knowledge to represent depth in his own paintings.

The simplest cue for the perception of depth is the *overlapping* of one object on another. The house that cuts into the field of view of another house, blotting part of it out of sight, must be in front of it. The artist, who has the job of putting the three-dimensional world on a two-dimensional canvas, uses overlapping constantly to get depth effects. *Lights and shadows* are used by the observer in much the same way. When light is coming from an angle, overhanging roofs will cast shadows on walls, upright objects will cast shadows on the ground. This is another technique that the landscape artist and even the portrait painter use quite consciously and deliberately. The photographer cannot manipulate the shadows, to be sure, but he does wait for the time of day when the shadows are best for his purposes. To show up ripples in the sand, for instance, the photographer will wait until evening when the sun is low, or he may even catch it early in the morning. The observer of the actual landscape, or of its pictorial representation, takes account of the direction of the light and builds up an impression of distance from the shadows. A third cue for the third dimension is the *relative size* of near and far objects. If the observer knows that all the posts in a fence are the same size, but the ones at the right gradually grow smaller, he sees the ones at the right as being of the same size but farther away. The artist uses this cue under the name of perspective and has exact rules for making the relative sizes accurate. In perception of distance some knowledge of size is necessary, of course. Likewise, if an observer knows the distance of an object, he can judge its size reasonably well. But he has to have one or the other to go by. In the case of an airplane in the sky, the observer must know the size or he cannot judge the distance. He can tell, if the plane grows larger, that it is coming toward him, but a small plane close at hand looks about the same as a large plane at a distance. Extraordinarily large structures, like the Empire State Building, look deceptively close because the estimate of distance is made on the basis of an underestimate of size. Still another

cue for distance is the *clarity* of things in the field of view. Objects at a distance look fuzzy; the outlines are unclear. The reason for this is that the lines are distorted slightly by dust particles in the air, and often colored a bit. In clear air the outlines are much sharper, hence people going from an industrial city to the virginal air of Arizona may be fooled when they try to estimate the distance to the mountains. These four cues for the depth effect can be utilized by a person with only one good eye. They can all be used by painters and photographers in getting the depth effect on flat canvas or paper. In Fig. 47 all four of these techniques cooperate to produce the depth effect.

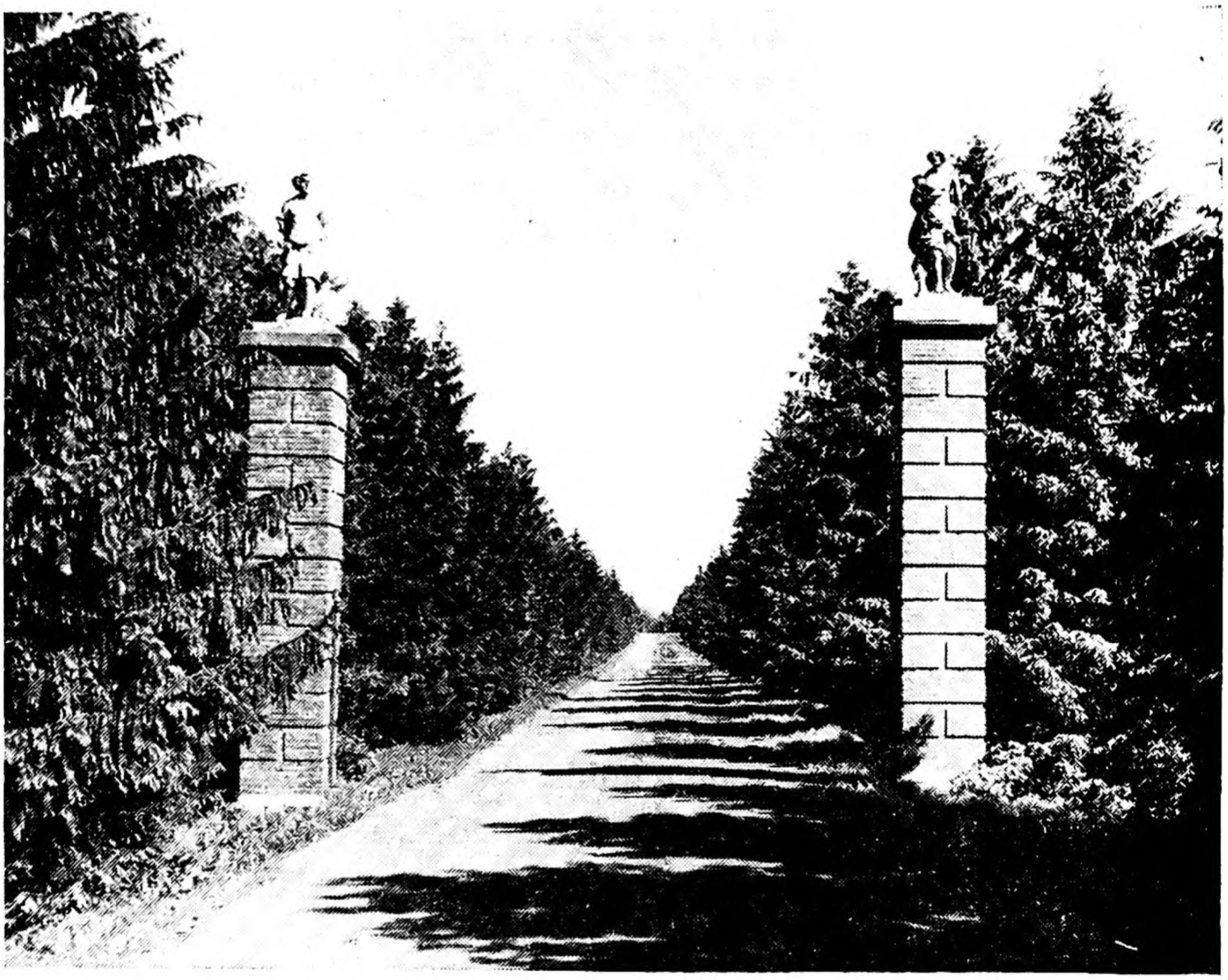


Fig. 47. Photograph illustrating several cues for the perception of depth. *Overlapping:* The trees on the left are perceived in front of the column. *Lights and shadows:* Since we habitually expect sunlight to come from above, the shadows on the columns indicate grooves to us rather than projections. *Clarity:* The trees in the background are fuzzy and are therefore perceived as farther away than the clearly seen trees in the foreground. *Relative size:* The smaller the width of the road, the farther away it appears to be. (*Courtesy of Photography Laboratory, University of Illinois.*)

Another way of perceiving depth can be used by a one-eyed person but not by a painter or photographer, because it is really muscular rather than visual. This cue is obtained when the eye accommodates to, or focuses upon, an object a few feet away. The reader can demonstrate this effect by holding both thumbs in front of his eyes, one a foot away, the other 2 feet away, and looking back and forth from one to the other. You will note that when your eye is focused on the far thumb, the near thumb is blurred a trifle, and vice versa. When you shift your focus from one to the other, the new *accommodation* (see page 84) takes a little time because it requires contraction and relaxation of the small muscles attached to the lens inside the eye. Since a fuzzy or unclear image is hard to adjust to—you could not reach out and pick it up if the outlines are blurred—it acts as a stimulus to the eye muscles to keep shifting back and forth until vision becomes clear, just as in focusing a camera. (Where there is some eye defect that produces blurred vision, the muscles may be working all day trying to clear up the fuzziness. Result: eyestrain and headache.) Now these muscles in the eye are equipped with kinesthetic sense organs, as are joints, tendons, and other muscles (see page 71), and, since focusing on any distance requires the same setting of the muscles each time, information from these kinesthetic sense organs gives information about the distance of the object in focus. Many range finders work in precisely the same way. If you adjust for 2 feet and the focus is good, the object in focus must be 2 feet away. It is fascinating to realize that the human eye can act as an automatic range finder, anticipating by thousands of years the modern invention of optical range finders. From the practical standpoint, however, this cue for depth is little more than worthless. It is useful only up to 4 feet or so and even for these short distances is not very accurate.

There is one cue for depth perception that requires both eyes; more than that, it requires that each eye get a slightly different view, hence the name: *retinal disparity*. This cue is a subtle one, rather difficult to grasp, and not completely understood even by the experts, but Fig. 48 helps to clarify it. With the pencil in the position shown, the image falling on the retina of the left eye will be smaller than the image falling on the right retina. There will always be some difference between the views obtained by the two eyes, as one can easily

demonstrate to his own satisfaction by making a hole of his thumb and forefinger, then looking through it with the right and the left eye alternately. If you hold a finger in front of your face and look at it with each eye alternately, different views will be seen. Since there is only one way of combining these disparate views into a clear unified pattern, as required by the laws of perception, the object can be seen at only one distance. The best way to realize the definiteness and accuracy of this cue is to raise this question, in connection with the figure: Why cannot the pencil be seen at a slightly different angle, such as the one shown by the broken line? Light from a point a little closer than the pencil point would fall on the same places on both retinas, and, after all, the only vision one has is of what falls on the retinas. It is double images that prevent any other depth effect from obtaining a hold. In order to see the pencil point a little closer than it is one would have to see two points, as shown in the figure. These two points would be mixed with each other and the effect would be blurred and confusing. This fuzziness, as we have seen before, is frustrating and acts as a stimulus for readjustment. The only way the fuzziness of these double images can be cleared up is to push the perceived position of the pencil farther back, where the images fuse into a clear-cut point. By the geometry of the situation there is only one point at which this can occur, hence it is that distance which we see, usually quite unambiguously. Recalling the principles of the formation of patterns, one can see here the operation of the principles of distance and similarity. If the pencil point is seen in front of or behind its true physical position, double images will be seen. The images are similar, not very disparate, and the distance between them is small. Therefore the natural tendency is to close the gap, sliding them together, and when this is done, the

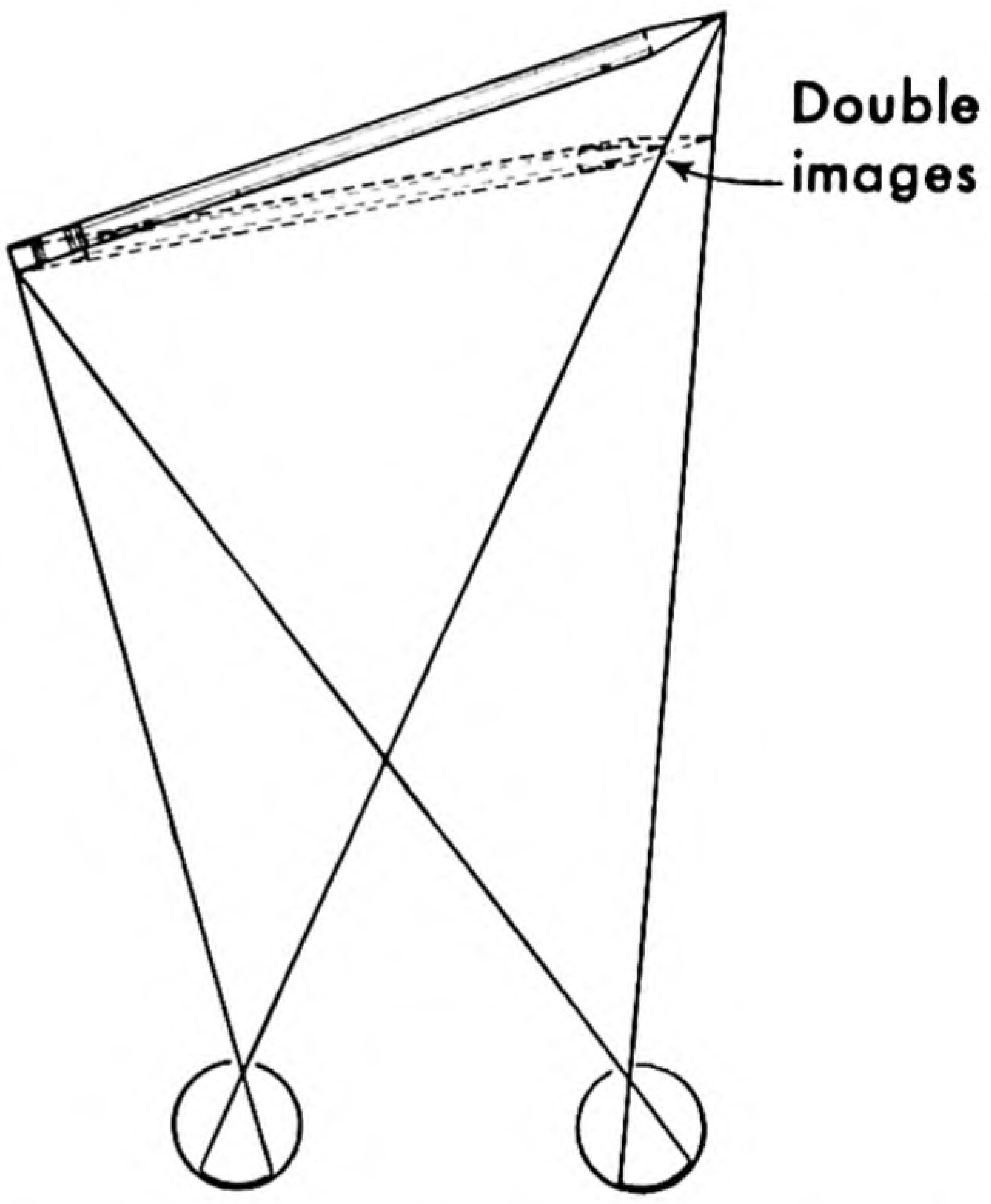
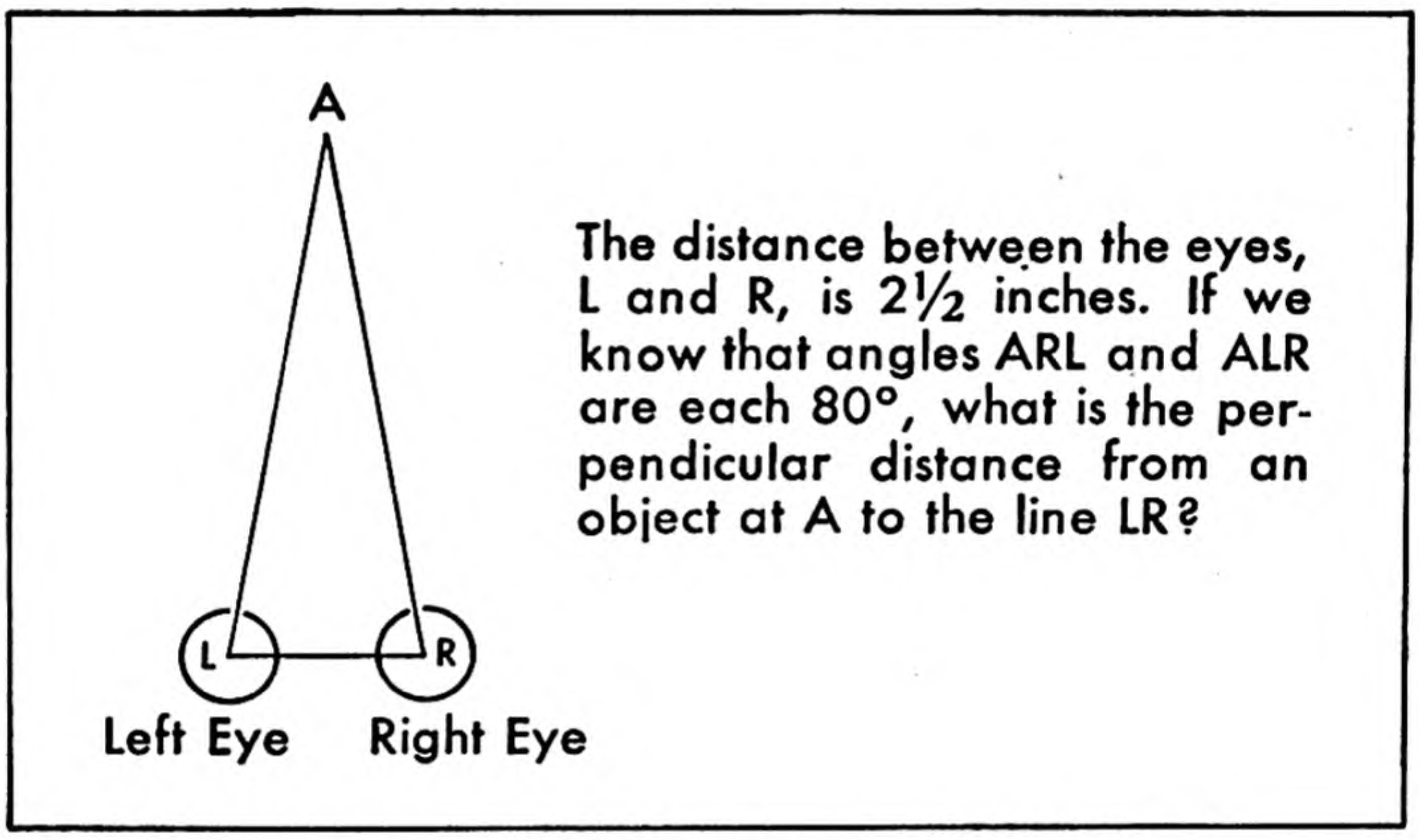


Fig. 48. Retinal disparity in the perception of distance. Suppose a pencil is at the position shown, about a foot in front of the eyes. Why is it perceived where it is and not a little closer? See text for explanation.

geometry of the situation requires that they slide into the position of the point from which the light came.

Retinal disparity is a very sensitive aid to the perception of distance. The eye can discriminate very small differences in size, as little as 1 part in 100. Hence a very small disparity is useful as a cue for distance, and it has been shown that disparity of views from an object as far away as 1,000 feet can be appreciated by a good observer.

In making use of retinal disparity, the eyes converge upon the object seen. This requires the proper adjustment of the muscles outside the eye that point each eye in the proper direction. *Convergence*, accommodation, and retinal disparity go along together. But perhaps convergence by itself is a cue for depth perception. If a student who has passed a college course in trigonometry knew the distance between the eyes, about 2½ inches for most people, and the angle of convergence of the eyes, he could easily compute the distance of the object on which the eyes are converging (see Fig. 49). Since the external eye muscles have kinesthetic sense organs, information about the amount of convergence is available and can be used as a cue for depth. The utility of this cue in actual use is hard to prove, however, because it is difficult to separate its operation from retinal disparity. It is probably of some slight value, up to 10 or 15 feet.



The distance between the eyes, L and R, is 2½ inches. If we know that angles ARL and ALR are each 80°, what is the perpendicular distance from an object at A to the line LR?

Fig. 49. Convergence and the perception of distance. Answer at end of chapter.

Seven cues for depth perception have been listed, four of which are available to people with only one eye and can be used by painters and photographers. Two are restricted to binocular vision and cannot be used by artists. But a one-eyed observer can get the same two

views of an object that a two-eyed person gets if he merely moves his head 2½ inches to one side. He has the handicap that he does not get these two views at the same time, but judging from the results of actual tests, this is not a severe handicap. Anyone looking out a train window can notice how perception of distance improves when the train starts moving. This cue cannot be used by painters and photographers, of course, but it is used in the movies.

Fig. 50. Young's pseudophone. Each ear receives sounds from the other side of the head. If the eyes are closed, auditory localization is reversed.

Usually all these cues work together, the more the better. That is why distances can be judged better in a landscape that includes many diversified objects, large and small, near and far, than in a barren landscape or the open sea. The observer, trying to find his way about, estimating distances, and judging objects, uses whatever cues

he can. When there is a conflict of cues, as in the many optical illusions, the observer tries one way of sizing up the situation and then another, until he finds one that permits him to get along with his work, or fits in with his perceptual attitude of the moment.

When auditory and visual localization disagree, visual localization is dominant. An American psychologist, P. T. Young,[6] working in Germany some years ago, invented a device to test this statement. He put a sort of speaking tube in each ear and curved them over his head so that the sound coming to the left side would be conducted to the right ear, and vice versa. He found that when his eyes were closed, he would hear sounds from the left as if from the right. But with his eyes open he heard the sounds coming from the direction where he saw the source of the sound. In other words vision is dominant over hearing. That is the secret of ventriloquism and that is why, in a movie theater, the sounds seem to be coming from the actor who is moving his mouth, though they may actually be coming out of a box some distance from the screen.

## ON WALKING DOWN THE STREET

There is a danger in leaving the psychology of perception in the form of disembodied principles, fundamental though they are, and illustrations of special cases. Since this book is interested in individual men and women—and this interest will heighten as the plot develops—let us see how helpful our knowledge of perception is when we follow a small boy out of the house and down the street, observe what he observes, and try to understand why.

When he bursts out the door, he enters a very different physical environment. The air has a different temperature as it meets his skin and the inside of his nasal passages. There may be a breeze bending the hair on the back of his neck and thus stimulating the receptors in the skin. Of course he sees the familiar trees and houses, and hears the sound of the breeze in the neighbor's elm tree and the distant puffing of the 4:30 freight. As he bounds down the stoop, the balancing organ in his inner ear and the kinesthetic sense organs in his muscles and joints are whetted in the way which is so delightful to all active boys. All these things may or may not be apprehended as such, but they are perceived as signalizing the world outdoors, relief

from restriction indoors, the promise of excitement. These experiences are sensed as good, because of their association in the past with fun.

Walking down the street under the trees, our hero might see the cement walk as a light, mottled, rectangular surface on a dark background but, his interests and attitudes being what they are, he will probably see it as a path, the conventional means of getting from here to there. The visual stimulation reaching his eyes from the walk is not uniform in a physical sense, as part of it is in sunlight and part in shade, but he takes all that in at a glance. He automatically adjusts to the illumination and the source of the shadows. Though he would not be able to describe the process, he takes illumination and shadows into account and walks firmly down the sidewalk stepping on light and shade without hesitation. But, if one should ask him to look at the shadows, he could change his perceptual attitude and judge size, shape, and brightness as well as the next boy. Or, if he were looking for a way of sharpening his knife, he would see the cement walk in still another light.

Along the street come a man and a woman. Our hero sees them as two of a kind, two uninteresting adults to whom one must be polite. Next a man and a boy approach. These are not grouped together as two of a kind but are seen as one who is interesting and one who is not. Three boys come next. Will he see three boys-to-play-with, or two boys-to-play-with and another whom he should not play with? The answer depends, of course, on our boy's previous experience and training.

The boy walks past the junk yard next, so we must now ask what was his purpose in coming this way. Because it will make a big difference in what he perceives in the junk yard. If he started out to look for a block of definite size to hold up the end of his doghouse, he will see anything with potential block character as a block, perhaps already in position. But, if he is merely passing by, the box that might be a foundation will be seen as merely an object capable of holding his weight long enough that he can jump to the next mountain peak. For when anyone is actively searching for an anticipated object, all objects are perceived as relevant or nonrelevant to that end. Their other properties, smell, consistency, and color, are attended to only marginally.

## READING AS A PERCEPTUAL TASK

People who interest themselves in books like this one are inclined to take reading for granted, but it is really an extraordinary and extremely artificial accomplishment, which requires many hours of specialized practice at a high level of skill and which, nevertheless, has been mastered by a goodly percentage of the human race. (In terms of cultural forces, as a means of communication underlying social interaction in literate societies, its role is equally impressive and will receive the attention it merits in a later chapter.) Let us consider reading as a visual task and see how much an average reader accomplishes in a minute. Taking 200 words per minute as an average rate for easy material and assuming that each word has five letters, it comes out that the reader reacts to 1,000 letters a minute. When we remember that each of these letters could have been any one of 25 other letters, which differ only slightly from each other, the achievement seems even more remarkable.

The speed attained in reading seems less startling, however, when the reader's task is examined more closely. It is true that to identify one letter, an *e* for example, for what it is, and not to confuse it with an *a*, *o*, or *c*, or any of the others, is a discrimination that would require about 0.3 second. To recognize 1,000 of these would take 5 minutes rather than 1, with the combining of the letters into words still to be accounted for. But the visual task in reading is not one of discrimination. It is not to be compared to the search for the hidden face in a puzzle picture but rather to the visual task in driving an automobile. One pushes rapidly along, taking in only so much as is necessary to stay on the right road and avoid uncertainty and error. The context already percieved sets up expectations for the words to come, and so long as the words agree with these expectetions, the merest glance will suffice.

Since any word is seen for such a brief period, the psychology of reading, in part at least, comes down to an investigation of the perception of words that are exposed to the reader quickly. The reaction time of the eye is known to be somewhat more than 0.1 second. Therefore, when a word is shown to a reader for less than 0.1 second, his eye cannot move from one part to another, hence whatever is

seen must all be taken in in one glance. Experiments under these conditions demonstrate that it is the general outline of the word, rather than the details, which establishes the pattern that is perceived, and that the length of the word and letters extending above and below the rest are the chief determiners of the outline. "Svelte" will not be taken for "to," but "lurk" might be read as "lark" or even as "hurt." The perception of words follows the principles listed in the preceding pages for perception in general. A word is a pattern, a whole that is more than the sum of the letters that are its parts. The parts are perceived in relation to the whole; in fact there are two typographical errors on the preceding page, which, because they fitted into the outline expected, were probably not noticed by the reader. The broad outlines set the pattern and, if this pattern does not hinder the train of thought started by the previous context, it will be accepted as the correct pattern. The reader does not attend to the individual letters, the excellence of the printing, or the condition of the type. He fills in any gaps to suit his expectations. The common metaphor that speaks of words as vehicles of ideas is a good one: the reader's attention is not on the vehicle but on its freight of meaning.

In a page of ordinary type the reader takes in from 10 to 20 letters, or two to five words, in one glance; fast readers may take in more. The eye lingers at one point just long enough to perceive the words, not necessarily to get the sense, then jumps along to the next group, pauses there a moment, then jumps again, and so on. A fast reader will take in a whole line in two or three glances; slow readers may need seven or eight. The eyes can be photographed as they hop along a line of type by the ingenious eye-movement movie camera pictured in Fig. 51. When this is done and the records analyzed, it comes out that about 90 per cent of the reading time is spent in looking at the type, in *fixations* of groups of letters, while the other 10 per cent is spent in moving from one fixation point to another. It is an awkward stop-and-go sort of progression, but entirely unconscious and fortunately quite unrelated to the feeling, smooth or jerky, which the reader gets from the text. During the time that the eyes are jumping from one spot to the next the reader, like the broad jumper, is out of contact with his jump-off place and landing place. But, since this time is only 10 per cent or so of the whole, it is a small waste, and it often

is not wasted at all, because some time is required for the meaning to sink in.

A more likely source of inefficiency in reading is due to the fact that our words are wider than they are high. In a horizontal direction the reader can take in as broad a span as he is able, 20 or 30 letters perhaps. But vertically he is limited to one letter. The letters on several lines above and below are seen but not used. Other arrangements are possible:

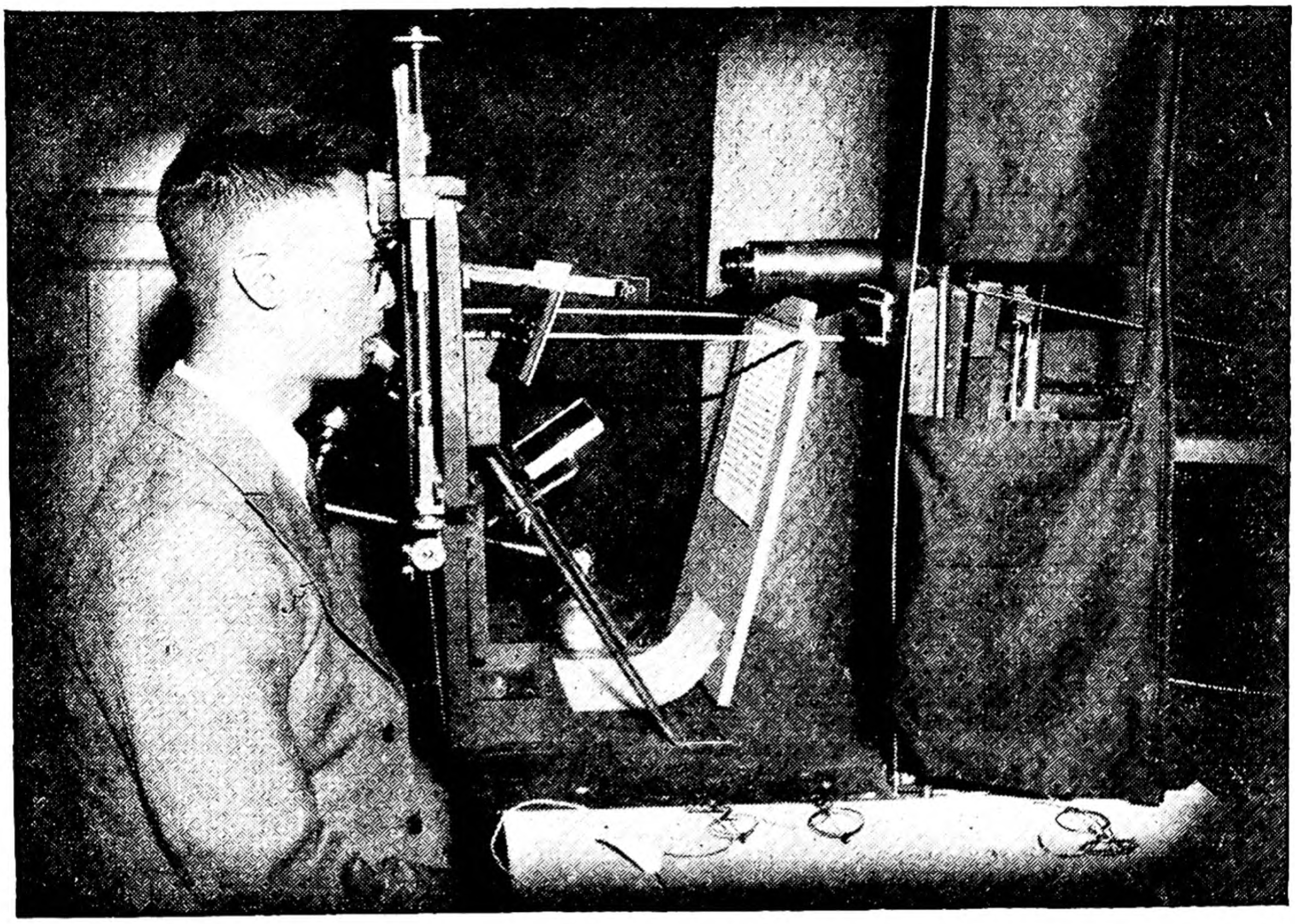


Fig. 51. An early eye-movement camera. More recent models are enclosed. (*Courtesy of W. R. Miles.*)

If type ar- as line it alto- pos-
the were ranged this is, is gether sible

that one could cover more ground with less optical work. The case has not been proved, but a Chinese character, representing a single word, is about as high as it is broad, and Chinese students do read a few more words per minute than American students.[7]

For most people the upper limit to speed of reading is set by the difficulty of the material read, not by the mechanics of eye movements. When the meaning is not clear, the reader lingers longer at

one fixation point. He may, in fact, read only one word at a time. And he may read one line, then jump back to the line above to reread it. These *regressive movements*, as they are called, are the time-wasters. The person with a good vocabulary does not have to retrace his steps to dig out the meaning of a sentence very often. That is why there is a close relation between one's vocabulary and his speed of reading difficult text. Of course, it is the ideas as well as the words used to convey them which impede reading speed. But the reader who has been able to master a good supply of five-dollar words is not likely to be stymied by an eight-dollar idea.

For some people with an adequate understanding of the words, speed of reading is checked by bad reading habits. A person used to reading difficult material may carry over his slow speed to reading the newspaper. Some people read very rapidly but do not adjust their speed to the subtlety of the text, thereby missing the less obvious points. And a few people, by some curious trick of fate or poor teaching, get into the habit of reading irregularly, of reading a little of one line, then jumping to the next, then jumping backwards to pick up the loose ends, and so on in an undisciplined way. Just as some people in adding a column of figures have to touch each with a pencil, some readers have to pronounce or at least mumble each word as they go along. Both these crutches slow down the procession. Then, too, there are certain eye defects, either of the lens or the muscles, which act as handicaps in this complicated task. Most of these difficulties can be cleared up by proper diagnosis and treatment. Many universities now have reading clinics equipped with the right apparatus and tests, and a psychologist trained in these problems.

For a person working by himself trying to increase his reading ability there are two practical suggestions. The first is to read with a question in mind. Read first to see what the writer is talking about, then, with that in mind, ask the text what the writer is going to say about it. The questioning reader is active, seeking an answer. He gets to the point and skips lightly over the nonessentials. The other suggestion is to develop several speeds of reading. In reading the fine print in a legal document, it is best to go slowly and to scrutinize every "whereas" and "to wit" closely. But in reading the newspaper or a novel the reader who pushes himself can usually speed up his progress and even relax his conscience about getting every word.

## ABOUT DREAMS

If the reader now thinks he has acquired some understanding of the psychology of perception, he might try out his skill on his dreams. For, after all, if the principles of perception are good ones, they ought to work for any kind of perception, not merely for the examples used in the exposition. The way to study dreams is to equip yourself with a pencil and a pad of paper when retiring, and write down your dreams as soon as you wake. If you have none to write down the first morning, or if the content seems too prosaic to trifle with, keep at it. You will soon have a padful, a psychic museum waiting for arrangement and analysis.

The trick is to trace the origin of each image that occurred in the dream. Some, it is clear, are produced by sensory stimulation: a cool breeze, tingling in the limbs, warming of the surface of the body next to the bedclothes, a dog barking, or stomach distress. But these things are not perceived sharply. Our dreams are bizarre, absurd, of the stuff that poems are made of. And the reason they are so bizarre is that they come to us out of context, without any frame of reference. With our eyes open and our brains alert, the alarm must be heard as an alarm because it comes from where the alarm clock can be seen, and it is part of the day's routine for the alarm clock to ring and, furthermore, there is nothing else in the room to make such a noise. But when we sleep the background is missing, we do not know where we are, and we have no expectation of what is coming next. Words are slippery enough, but, unlike reading, in which each word is seen in a context established by the preceding words, dreaming depends upon the raw material coming from the sense organs to a practically unprepared brain. The sound of the alarm clock could equally well be heard, and is heard, as a telephone, a fire alarm, or a doorbell.

Now, if the background is lacking, what will account for the interpretation put upon the sensory data? Almost anything, apparently: memories, especially emotional memories, associated with the sensory stimulation, sensory stimulation coming from other parts of the body, trivial associations, and, most important of all, sets carried over from the previous day or days. When a person is tensed for any venture but never carries the venture through to completion, whether for lack

of a suitable opportunity, pressure of other activities, or some personal or social taboo opposing the venture, the tension may persist, popping up as a distraction later in the day or even operating under the cover of night, when vigilance is low and the opposition may be caught napping.

Suppose you have been trying to tell your favorite story to some new friends at lunch.

"Now that reminds me of . . ."

But no one seems to care. Catching another break in the conversation you begin again.

"There's one like that about a . . ."

But still no attentive eye or ear. They go on discussing the coming concert in University Hall. If your urge to tell that story is compelling enough, it may crop out in your dreams. You may hear the alarm and see the toastmaster, who has just stepped out of a concertina, ring a 10-inch lucite gong, hushing the whole crowded dining room —which is now in the middle of the stadium—and turning every eye in your direction while you climb on top of the goalpost to tell the one that always brings down the house.

The motivation behind the dream may be so strong that very little immediate sensory stimulation, or none whatever, is necessary. This is the case when the motive is a frustrated desire or a persistent anxiety, especially so if it is a motive that the dreamer is not proud of and likes to ignore during his conscientious waking life. In fact the psychoanalysts use dreams as a starting place and starter for free association, attempting to work backward from the dream life to the more persistent and prominent emotional themes in the dreamer's waking life. It is not that the psychoanalysts are interested in the dreams for their own sake, but they use the dreams as a kind of inkblot, allowing their patients to talk freely and loosely about their dreams, or merely to mention things that come to mind when they think about their dreams, so that sooner or later the patients' dominant motivations and emotional tensions will come to the surface.

## INDIVIDUAL VARIATIONS IN PERCEPTION

In some ways perception improves as one grows older while in other ways it becomes worse. If the perceptual task is one that requires

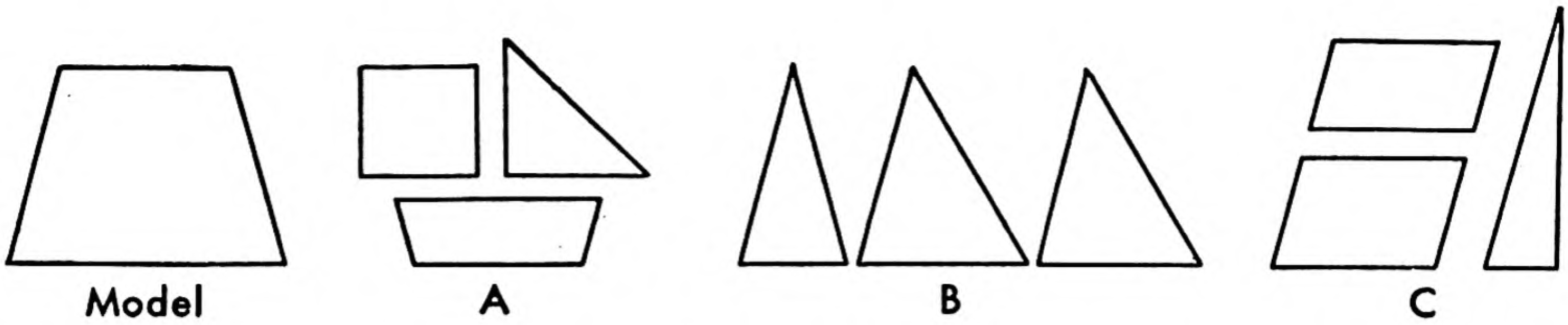


Fig. 52. Which group of parts, *A, B,* or *C,* can be put together to make the model?

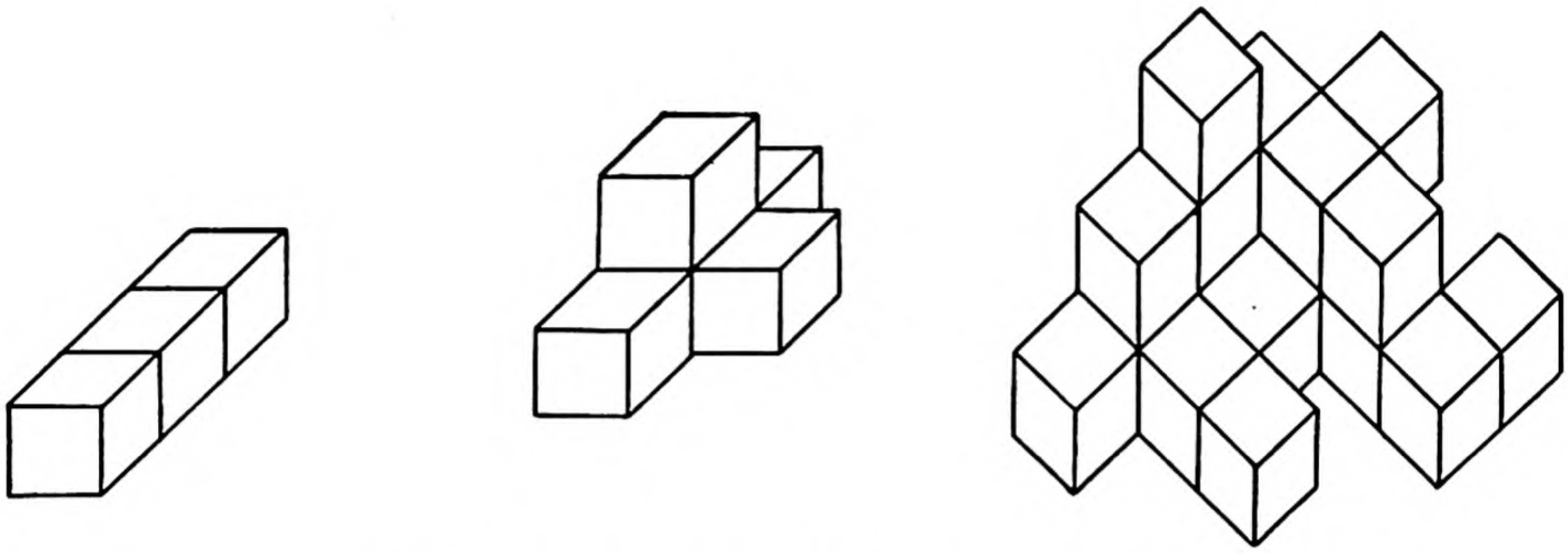


Fig. 53. How many blocks in each pile?

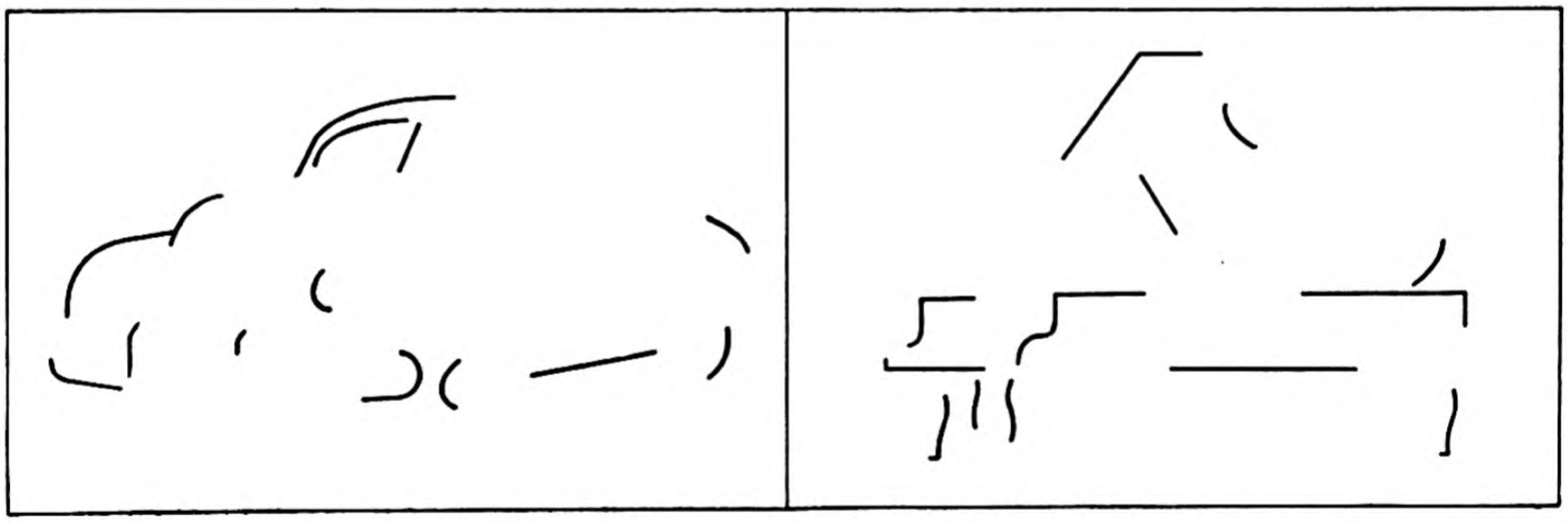


Fig. 54. What are these objects which the artist left unfinished?

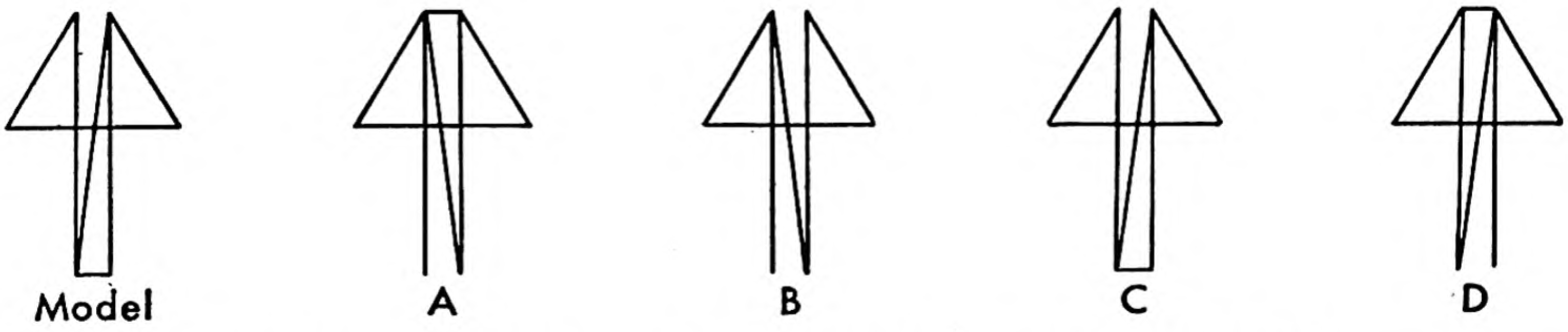


Fig. 55. Which figure is exactly the same as the model?

speed, the older people are at a disadvantage. In jobs requiring steadiness and adherence to standards, as in inspecting, the greater experience of the older people is more valuable; they know what to look for.

Because perceptual skills are important in such a wide variety of jobs today, many tests have been devised to measure individual differences in various perceptual performances. For example, Fig. 52 is a sample of the kind of item that appears on tests of pattern formation or spatial relations. The question is which group of parts, *A*, *B*, or *C*, can be put together to make the model.

The next figure represents three items from the widely used block-counting test. The instructions are to count all the blocks in a group. As in most other tests one progresses from the easy up to the difficult.

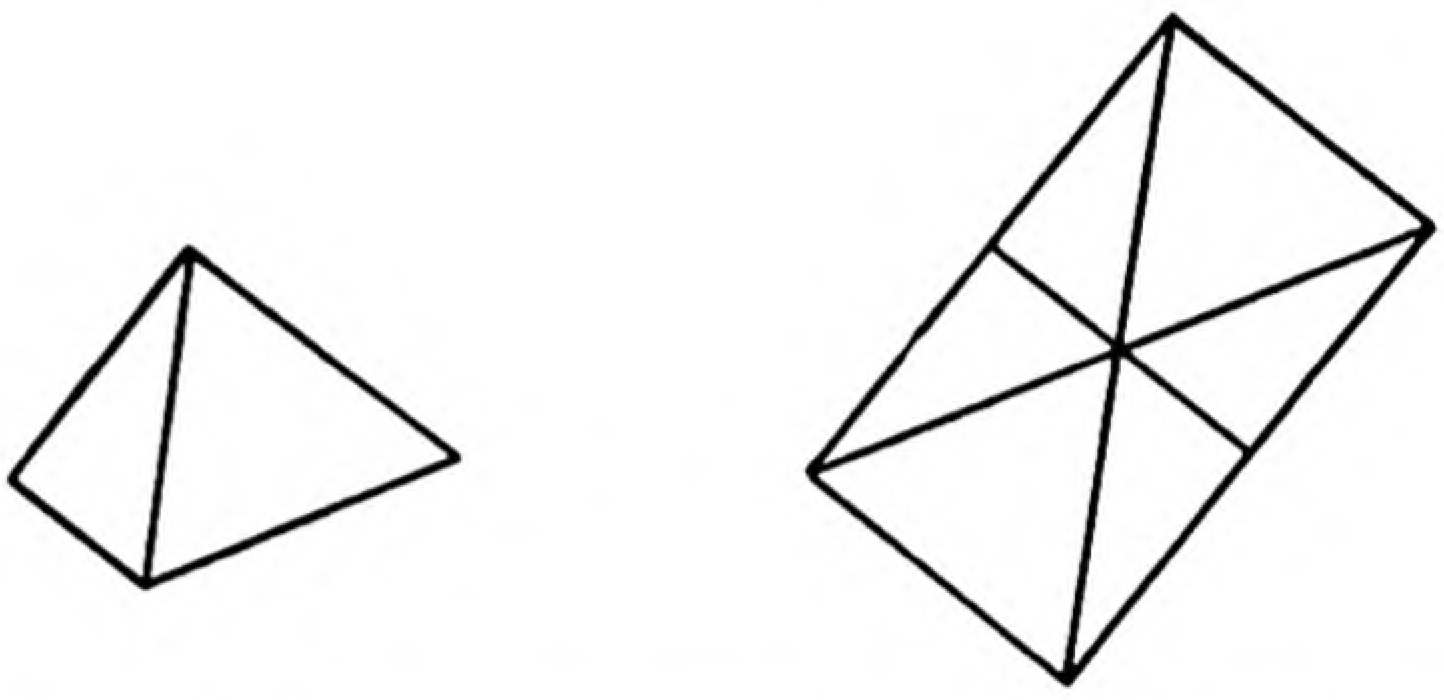


Fig. 56. Can you perceive the design on the left in the one on the right?

In the next kind of item the designs are only partly complete, the observer being required to fill in the gap and name the object perceived. These can be made very easy and very difficult. Much that we do in daily life requires filling in the gaps and struggling along on the basis of inadequate data.

Then there are perceptual tests in which the observer is asked to note similarities and differences. One is shown in Fig. 55. The question is which one of the four on the right is identical with the model. Almost anyone can get such items right in time, but some people do these much faster than others, almost automatically.

One of the most fascinating tests of perception requires that the observer grasp a pattern, then identify this pattern when it is imbedded in another, more inclusive pattern. In Fig. 56 the instructions are to mark the part of the second design that is the same as the first. The reader who remembers the principles of perception will be able to deduce the reason for the difficulty of this task. It necessitates holding onto a pattern while exploring another one, and breaking up the second pattern so that the parts that are identical with the parts of the first can be combined as the parts of the first are combined.

Tests for the perception of depth have attracted much attention recently because of wartime interest in aviation and the postwar dream

of an airplane in every garage, although the ability to judge distance is just as important to the automobile driver as it is to the airplane pilot, to say nothing of the duck hunter and the center fielder. Since depth perception depends upon many different cues—seven were listed a few pages back—obviously many kinds of tests for depth perception can be constructed. One common test uses two vertical sticks, one of which is stationary, while the other is adjusted back and forth by the observer until he judges that he has it at the same distance from him as the stationary stick. In a simple setup like this there is no cue from overlapping, of course, and any help from shadows can be eliminated by flat lighting. What is tested is the accuracy of perception on the basis, chiefly, of retinal disparity. Other tests are put together so that the observer sees a more diversified field and lighted so that shadows and other common cues can be used. In general, the best tests are those which are similar to the conditions under which the applicant is going to work. But the problem of evaluating a psychological test for any specific purpose is a serious one, not to be settled merely by logical analysis, which must be given serious consideration in Chap. 10.

Tests of many other aspects of perception have been devised for special purposes. Reading tests are tests of perceptual speed when the material is easy. A test that requires the ability to preview a pattern and plan its construction is the well-known maze test, in which a person has to draw a pathway from starting point to goal, choosing among several inviting paths along the way and avoiding the blind alleys. In these tests the examiner uses a stop watch and gets a measure of speed as well as accuracy.

Several of these tests have a good deal in common, *i.e.*, the ability required for success in one overlaps with the ability required for success in another, for a person who scores high on one test is likely to score high on another. One thing that many of these tests have in common is that they require the subject to grasp and manipulate spatial relationships (see Figs. 52-54). This thing, or factor, which is common to a group of such tests, is called the *space factor*, more precisely, the *visual space factor*. It is often included in tests of general intelligence.

In the diagnosis of some types of brain injuries, tests of form per-

ception and grouping have been found to be quite valuable, and they may in time lead to a better understanding of mental abnormalities.[8] The patient is shown a collection of objects of many colors and shapes and asked to "put those together that belong together." Some will group them on a basis of size, some on the basis of color, and some on the basis of shape. Then, if asked to abandon the first way of grouping them and group them on some other basis, normal people can do so, but patients with damage to some areas of the brain are unable to make the shift. Once they perceive the objects in terms of color they continue to perceive them in terms of color, while the people with intact brains are able to perceive them in several different ways. It is not a matter of mental deficiency, for the feeble-minded—unless it is the sort of feeble-mindedness due to brain injury—do as well at this test as they do on any, while the brain-injured or aphasic patients who do poorly on this test may do very well on other tests.[9]

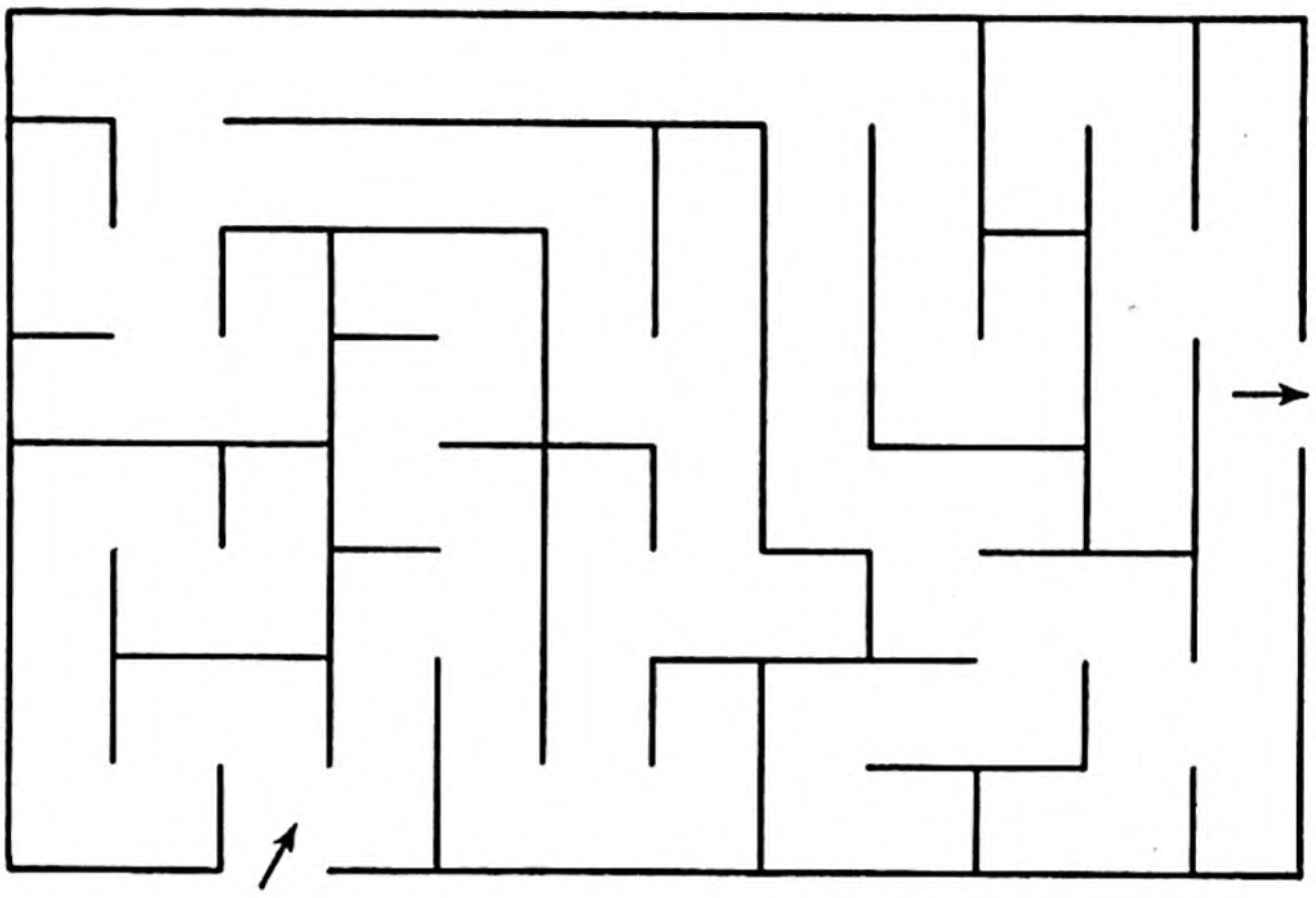


Fig. 57. How rapidly can you go from one arrow to the other without crossing any lines and without retracing?

Now the tests mentioned thus far have been invented in order to measure excellence of performance on some perceptual task or perceptual defects of a special kind. But since it is a principle of perception that what one perceives depends not only upon the external situation but also upon the perceiver's inner attitudes, perceptual tests are also useful for bringing these attitudes to light. If we show a person some pictures of white boys and colored boys, arranged so that they seem to be fighting, though the events are not very clear, and ask

him what he sees, the answer will often reveal the person's attitude toward relations between white and colored boys. He may give away his mental sets or prejudices, what he expects white and colored boys to do. If two people walking down the street see the same incident—violence in connection with a strike, let us say—they may, if their sympathies are opposite, perceive quite different events. At least their subsequent reports of what they saw are likely to differ considerably. Another perceptual test, consisting of a set of ink blots, similar to the one a few pages back except that some are in colors, has been developed by a Swiss psychiatrist named Rorschach and is now widely used as a personality test. Experts in the use of the Rorschach—and it takes several years of training to become an expert—can often describe a person with astonishing accuracy, his ways of thinking, his attitudes toward himself and the rest of the world, his anxieties, and his strivings, solely from his responses to ten ink blots.

## SUMMARY: PRINCIPLES OF PERCEPTION

What one perceives, and responds to, depends chiefly upon two sets of independent variables: (1) one's readiness or preparation for perceiving, which may be established by a motive, by voluntary intention, by instructions from others, and by habit, and (2) patterns of excitation in the nervous system, which are related, by such principles as distance, similarity, and familiarity, to the physical stimuli. The stronger the influence of one set of determinants, the weaker is the relative influence of the other. That is, if the stimulus pattern is clear-cut and unambiguous, the less important is the influence of motivation, and vice versa.

These principles account for such significant human activities as locating objects in space, representing the world on a two-dimensional canvas, reading, and dreaming.

Differences between one person and another in perception are determined by differences in the sense organs, by age, by habits of perceiving, and by fundamental perceptual abilities. At least one perceptual ability, called the space factor, consists in the ability to identify and manipulate spatial relationships, and is an important component of general intelligence.

intensity difference

figure and ground

depth perception

frame of reference

overlapping

ambiguous figure

accommodation

retinal disparity

familiarity convergence

perceptual

fixation introspection

discrimination

matching

Rorschach localization

# 7

## LEARNING

Fifty years ago the neighborhood was chatting happily over the back fences about the new Stone baby, a tender armful of smoothness and passivity, who lay calmly in his pink-lined crib and asked nothing of this world but to be well fed and comfortable. Today that same organism is Mr. David L. Stone, a skilled jeweler and a fair poker player, who is proud of his family and his giant dahlias, wears bifocal glasses, votes as an independent, worries a little about his stomach, and dreams now and then of owning a helicopter. What happened in the intervening 50 years to produce such a comprehensive change? How do innocent babies, with potentialities for development in many different directions, actually turn out to be adults like Mr. Stone, Mrs. De Giacomo, and Miss Eisner?

Development from conception to maturity and on into old age is a very complex affair, which has aroused the interests of playwrights, pediatricians, and poets, as well as psychologists, but the latter, who like to think clearly about these things, separate the development into two principles: maturation and learning. *Maturation* is a continuous and irreversible growth process, coextensive with life itself, and relatively independent of outside stimulation. Birds grow wings and fly. Fish grow fins and swim. Children grow legs and walk. They do not have to practice much at these skills; they are hereditary capacities that "just come natural." Children develop the ability to walk in about 14 months on the average. Development of the sexual apparatus, and an interest in its function, takes much longer, about 14 years on the average. Parental encouragement and discouragement do not have any lasting effect on these aspects of the growth process. Later the flesh and the spirit of these organisms will grow old; eyes, ears, and animal drives will weaken. All these biological changes are due to the progressive differentiation of nerves, muscles, and glands that goes along with age. All fish and fowl, boys and girls, go through

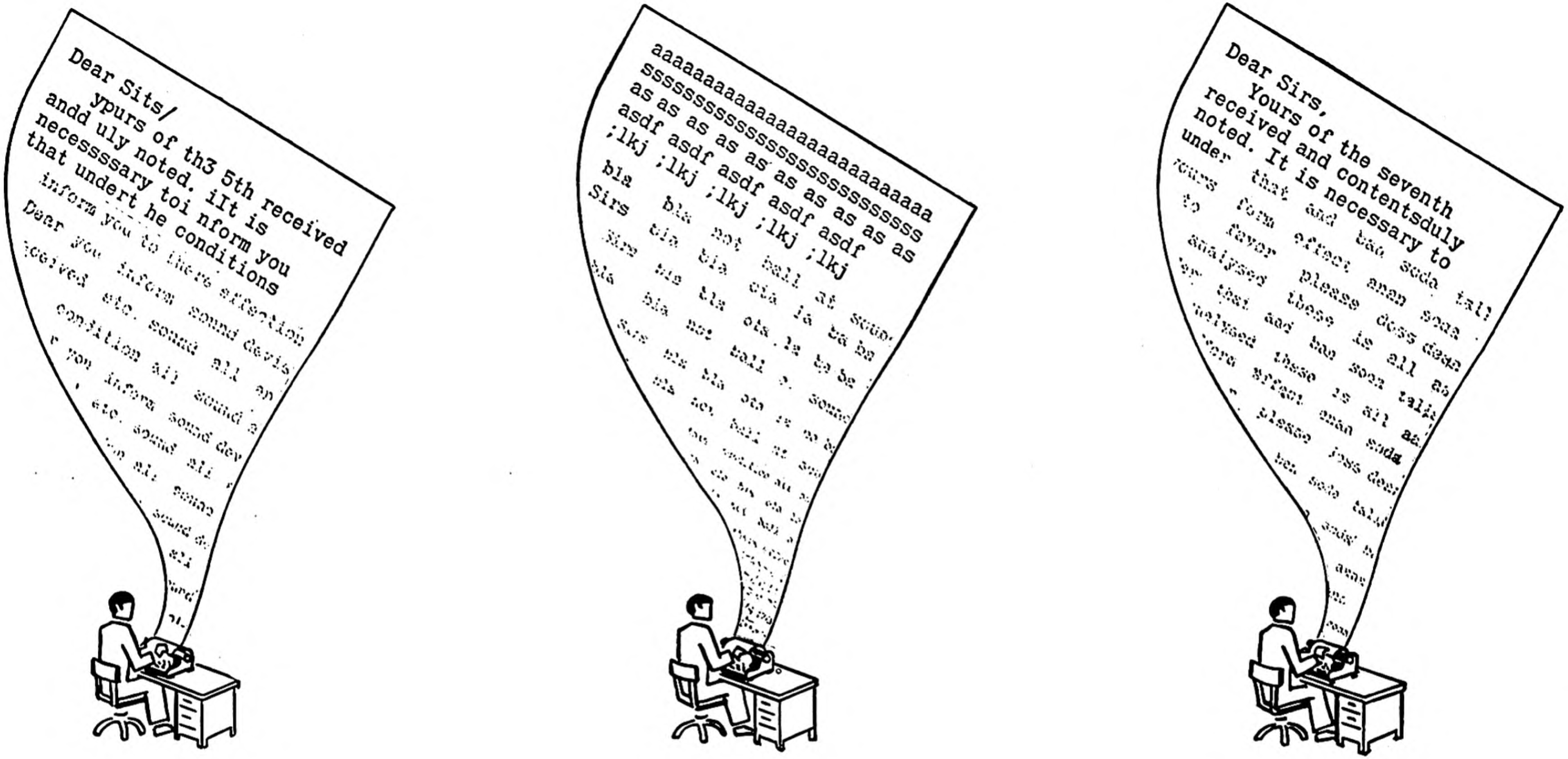
these changes. They are natural modes of behavior for their species, inherent in their constitution.

Biologically there is a great advantage to this sort of development, representing the end of a long process of evolutionary adaptation, as in the case of an important and very complex activity like walking. If one had to *learn* to walk, by diligent practice, the way one learns to play the piano, it would take a long time, and many would never do it well. If the infant had to *learn* to suck, it might be dead from starvation before it did so. By the maturation of hereditary potentialities, insects develop complex behavior patterns in a few days and then are mature individuals, able to find food and to defend themselves. The disadvantage, of course, is that only stereotyped, inflexible behavior patterns develop in this way. The development of adaptive behavior, changing with changes in the demands of the environment, is a different and biologically higher type of development, which is called *learning.*

Suppose a dog masters the trick of walking on two legs, any two legs. Or a girl acquires the ability to swim, or fly, or an interest in Early American furniture. These are not natural developments; they require practice; they do not occur in all dogs or all girls; they are not passed on to the offspring by heredity. Learning is the name for the process by which such behavior patterns develop. It is the theme of this chapter. Learning is a hazardous process, dependent upon the vagaries of the learner's motivation, his capacities, examples for emulation, and opportunities for practice. Experimentally, psychologists differentiate maturation from learning by controlling this factor of practice or training. If an activity appears at a certain age in the life span of the individual, with or without practice, maturation must be the reason. But if the activity requires practice for its development, and does not occur when practice is prevented, it must be due to learning. When all the requirements for this wonderfully adaptive process are in order, learning is manifested in such civilized developments as playing the violin, reading, splitting an atom, and putting up arguments against a higher income tax.

## HOW THE LEARNING PROCESS IS ANALYZED

Thoughtful men and women have always been interested in learning, but it was only about a hundred years ago that scientific investiga-



**First Test**
One letter of average length
15 minutes
12 errors
**Four oorrect words per minute**

**Practice Period**
A half-hour a day
for three weeks

**Final Test**
One letter of average length
5 minutes
3 errors
**Twenty correct words per minute**

Fig. 58. How the learning process is analyzed. Learning, by definition, is the change due to practice between the first test and the final test. So a test is given and the subject's scores are recorded: amount done, errors, time, etc. Then he practices. Then he takes another test, and the same scores are recorded. The difference between the last score and the first score is the amount learned. Several varieties of this basic technique are described in this chapter.

tion of the phenomenon got under way. Philosophers and teachers had talked and written about learning, often profoundly, but still only speculatively, until a method was invented for attacking the problem experimentally. The great German psychologist, Hermann Ebbinghaus, found a way to measure the improvement with practice, wrote a book about it in 1885, and, with modern improvements, the method is now so simple that any intelligent psychology student, with reasonable diligence, can perform an experiment on learning after a few hours of instruction. As Fig. 58 shows, the ingredients of a learning experiment are quite simple.

The first requirement is that the aspect of behavior under consideration be measured, or at least recorded, in some way. In the case of typing, the number of errors per page can be counted, or the time required for typing a page. The results of this first test are recorded before practice. Then the subject practices for a period. Then those same aspects of behavior are measured again in the same way. The difference between Test 1 and Test 2 in time required or number of errors is the improvement, and it must be due to the practice, if the conditions of the experiment are kept under good control. That is all there is to it. The evidence that a person has learned something is that his behavior has changed in some way, not necessarily for the better, between the first observation and the second, provided it can be shown that the change is a relatively permanent one, due to practice rather than maturation, sensory adaptation, fatigue, or a change in motivation.

As a result of learning, behavior may change in several respects. Some acts are performed more often, and others less often. Those acts or responses which one is trying to make, called "successes," usually increase in frequency; other responses, which interfere with his progress, called "errors," usually decrease in frequency. Ordinarily speed is stepped up. These are the principal dependent variables investigated in learning experiments. The essential question asked in the experimental analysis of learning, and in all other experimental sciences, is: What independent variables are related to these dependent variables? To answer this question, psychologists have set up experiments to demonstrate the effects of such conditions as kind and amount of motivation, kind and amount of practice, all sorts of variations in the stimulating situation and the material to be learned, the presence and activities of other people in social contact with the learner, methods used by

the learner, the time when these independent variables are introduced, and many others.

The experimental analysis of the learning process is a well-developed section of psychology, with a large body of scientific accomplishment to its credit. In simplest form the sequence of a learning experiment goes like this: first test, practice, final test. Some aspect of behavior (the dependent variable), such as number of words typed per minute, is recorded, then the subjects of the experiment are allowed to practice for a while, then they are tested again. By having the subjects practice in different ways or for different lengths of time, the effects of these independent variables on the amount of improvement can be investigated. Other terms often used instead of practice are *training* and *acquisition* of new responses. We shall see that new responses are acquired in several different ways and shall try to understand why.

The second phase of the learning process is *retention.* It is not enough to know how new responses are learned; we should also like to know whether they are retained or forgotten. A retention experiment takes this sequence: practice, first test, retention period, final test. The difference between the score on the first test and the final test is the amount forgotten. Usually practice and forgetting go on alternately or perhaps simultaneously, but in the laboratory the practice conditions are held constant when retention is under investigation.

The third and the most crucial phase of the complete learning process is performance on the final test. In learning, as in anything else, it is the final results that count. The final results depend, of course, upon the original practice and the retention of the practice effects, but in order to investigate the influence of the conditions of the final test, such as motivation and fatigue, the practice and retention conditions are held constant. If the material that is learned consists of words, pictures, and the like, the activity during the final test goes by such names as *reproduction, recall,* and *recognition.*

The scientific reader will notice that this plan of analysis conforms to the classic method of experiment, which has proved so powerful a method in physics, chemistry, bacteriology, pharmacology, and agronomy. A complex process is broken down into a few phases; then, by holding other phases constant, any one phase can be isolated and studied by itself. That the method is also productive in the psychology of learning is a tribute to the general potency of the method and also

to the ingenuity of experimental psychologists in devising techniques for applying it to their particularly subtle object of investigation. The procedure seems very simple now, but the human race had made much progress in other directions before it discovered how to investigate progress in learning. We shall study these three phases of the learning process one by one, beginning with the original practice period in which new responses are acquired.

## ACQUISITION OF NEW RESPONSE PATTERNS

One of the unsettled questions of psychology is whether there is just one process by which new things are learned, or several. At the present stage in the history of our science four types can be identified: (1) *varied activity*, (2) *conditioning*, (3) *organization*, and (4) *social interaction.* All these are complicated by the process of generalization. We shall examine these four, one at a time, and later see what they all have in common.

**1. Varied activity, or trial and error.** Let us begin by examining a simple case of learning in slow motion, as the Yale psychologist, Dr. Robert M. Yerkes,[1] did almost 50 years ago. He put a turtle in a box, separated him from his nest by partitions and inclines, then sat down to see what would happen. At first the turtle meandered about to his heart's content, exploring corners, backtracking, and finally reaching the nest after 1 hour and 35 minutes. The next time Dr. Yerkes put him at the starting place, he cut out some of the useless rambling and backtracking. By the fifth time his course was fairly direct—for a turtle—as Fig. 59 shows, and it took him only 16 minutes. On the tenth trial he did it in 4 minutes, and in 20 more he had his time down to a record 3 minutes and 20 seconds. When a series of events like this occurs, it is obvious that the animal is motivated by the nest-seeking or homing drive, which can be observed in many of the lower animals, and perhaps also by the exploratory drive. The motivation raises the level of general activity and, since the turtle is a fairly versatile creature, his behavior is variable. He does many different things, including the right ones. As he continues to practice, the irrelevant turnings are eliminated from his routine, and we can say that he has acquired a new sequence of responses, a new pattern of activity.

For our next example of learning through variations in motivated

activity let us look in on David L. Stone. One bright courageous morning Mr. Stone decides that he ought to learn how to type. Being a man of action he gets a typewriter and goes to work. He wants to write "Stone," so he hunts over the keyboard for *s*, scraping the *d* as he does so. Then he looks this way and that to find the *t*. His brow is wrinkled and he is probably mumbling to himself; he is working hard. Then he looks at what he has written, becomes dissatisfied and tries to find something to punch to make a capital *S*. A good writer could make the procedure quite comical. But in this chapter we have nothing against Stone; it is only necessary to observe the wide variety of things the learner does when the situation is complex and he is well motivated. Of all the many motions he goes through, the consequences of some of them will impress him as good, will reward him. It is these that the learning process selects. These are more likely to be repeated on the next occasion. The irrelevant motions, scraping an adjacent key, scowling, mumbling, hunting, and the like, all these will gradually be reduced. Eventually Stone will type a letter that he is willing to sign with his own name. It is the acts which fit in with Stone's general over-all activity, those which aid progress toward his goal of the mo-

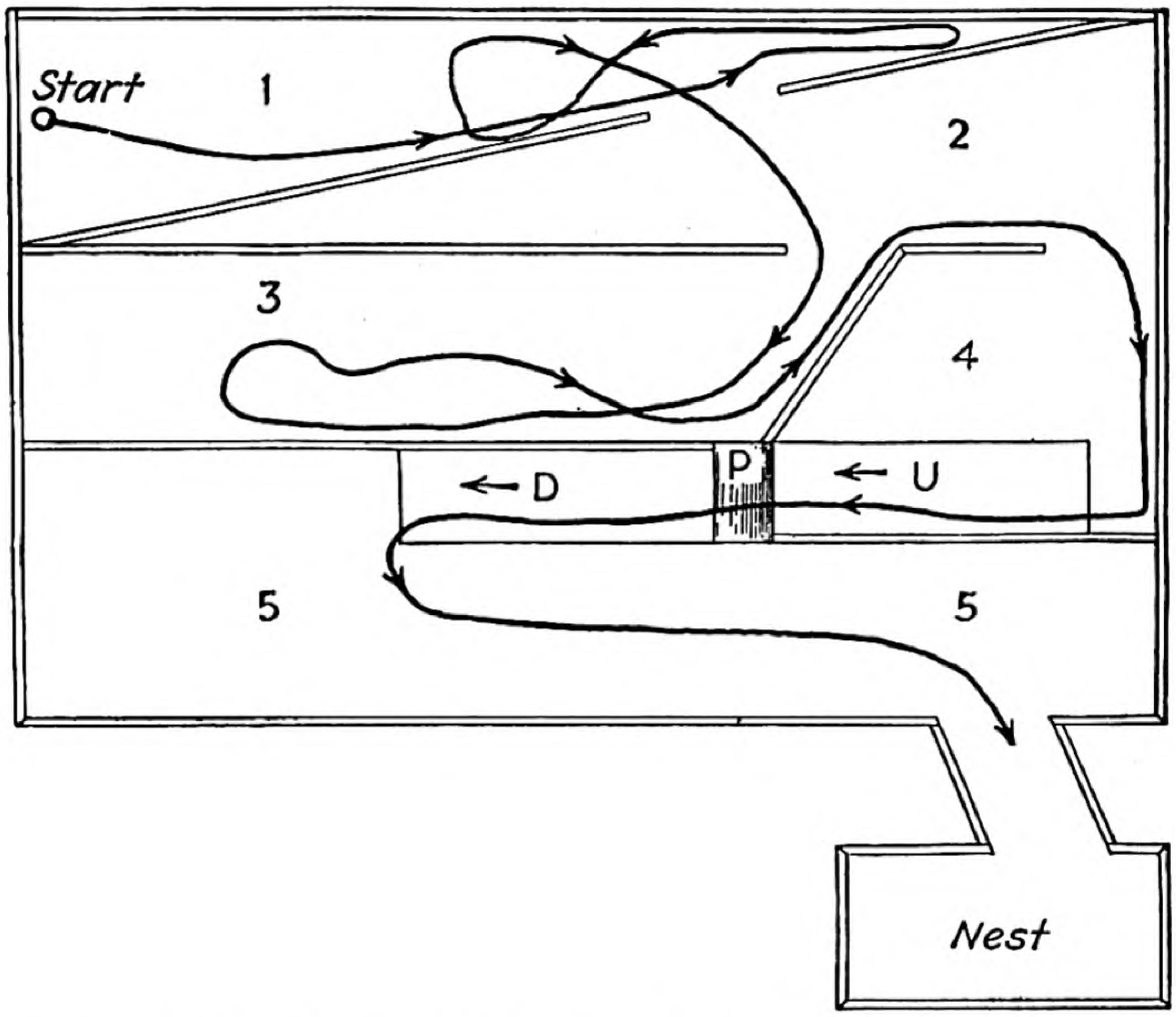
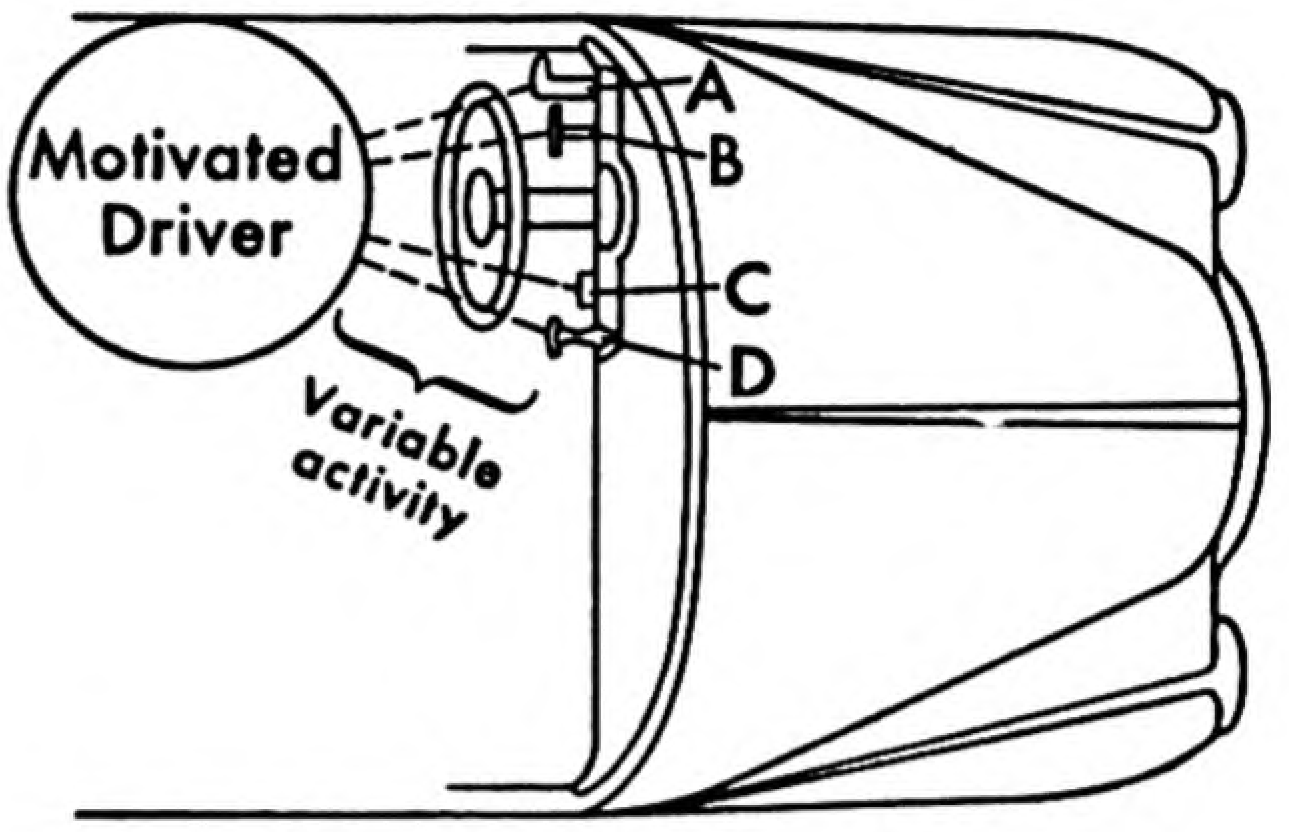


Fig. 59. The course of Professor Yerkes' turtle on its fifth trip through the maze. *U* and *D* are ramps leading up to and down from the ramp *P*. (*From Pop. Sci. Mon.*, **58**, *519-525, 1901. By permission of R. M. Yerkes.*)

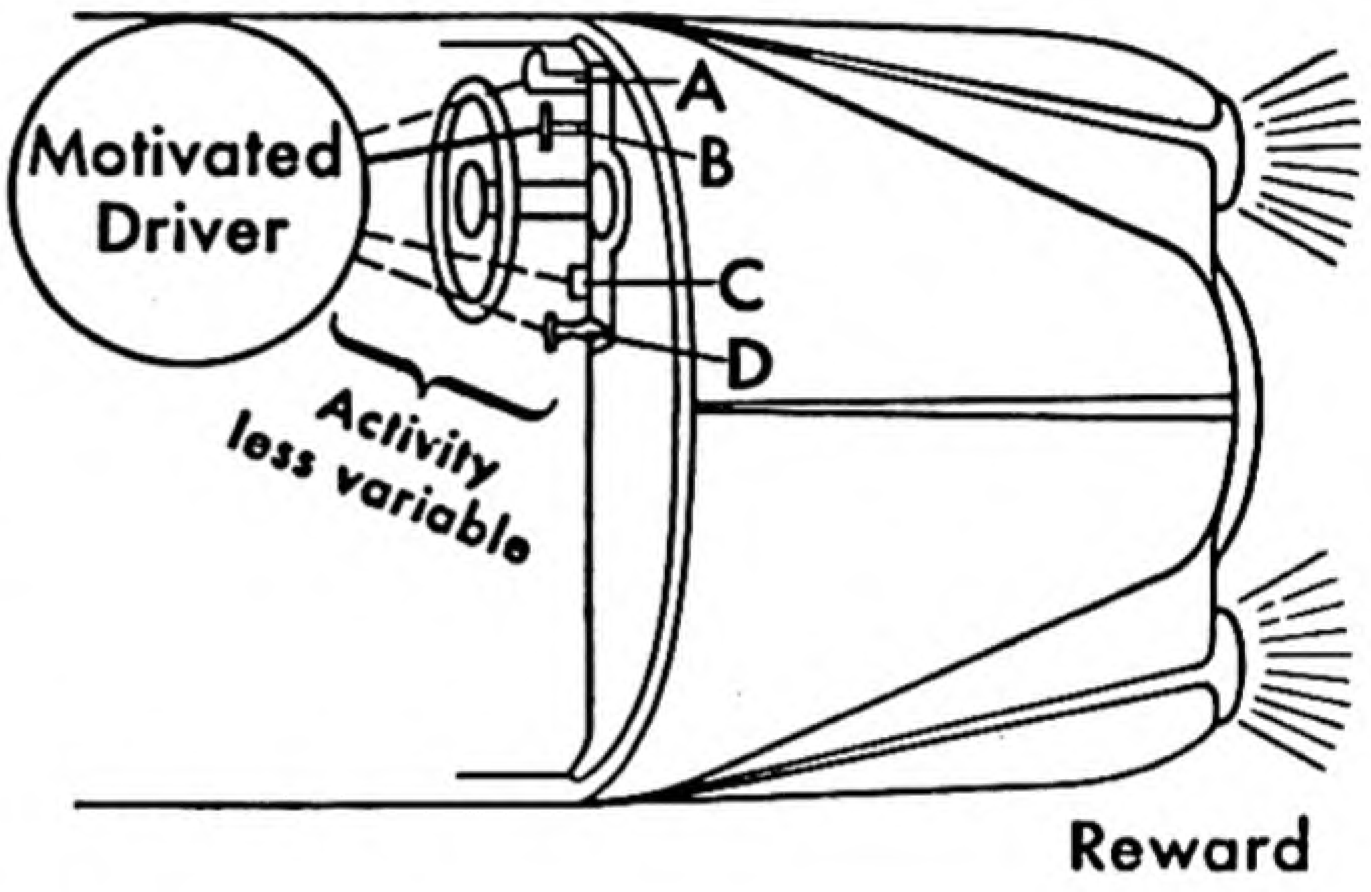
ment, that are retained; those acts which impede his progress are likely to be eliminated sooner or later.

In broad outline the same steps are seen when Mr. Stone learns other complicated activities, like driving an automobile (see Fig. 60). First comes the motivation, for if he does not want to learn, he usually does not learn very much. The motivation has two functions. It increases activity, spurring the man or animal on to try different responses, some of which may be effective. It also defines the goal response, more or less clearly. When the turtle reaches his nest, he relaxes. When Mr. Stone types the letter he wants to type, he is happy; when he hits a wrong letter, he knows it is an error and his activity is impeded. It is a general principle, called the *law of effect,* that responses which have

Because he is motivated to turn on the lights, the driver tries everything he sees in his new car. He lifts handle *A,* pulls rod *B,* pushes button *C,* and turns lever *D.*



But the only one of these acts which is rewarded is pulling rod *B,* which turns on the lights. So, on the next occasion, the tendency to pull rod *B* will be greater, while the tendency to do any of the other things will be less. Activity becomes less variable, or more predictable.



With just a little practice the other acts are eliminated altogether, and *B* is pulled every time. Learning is complete.

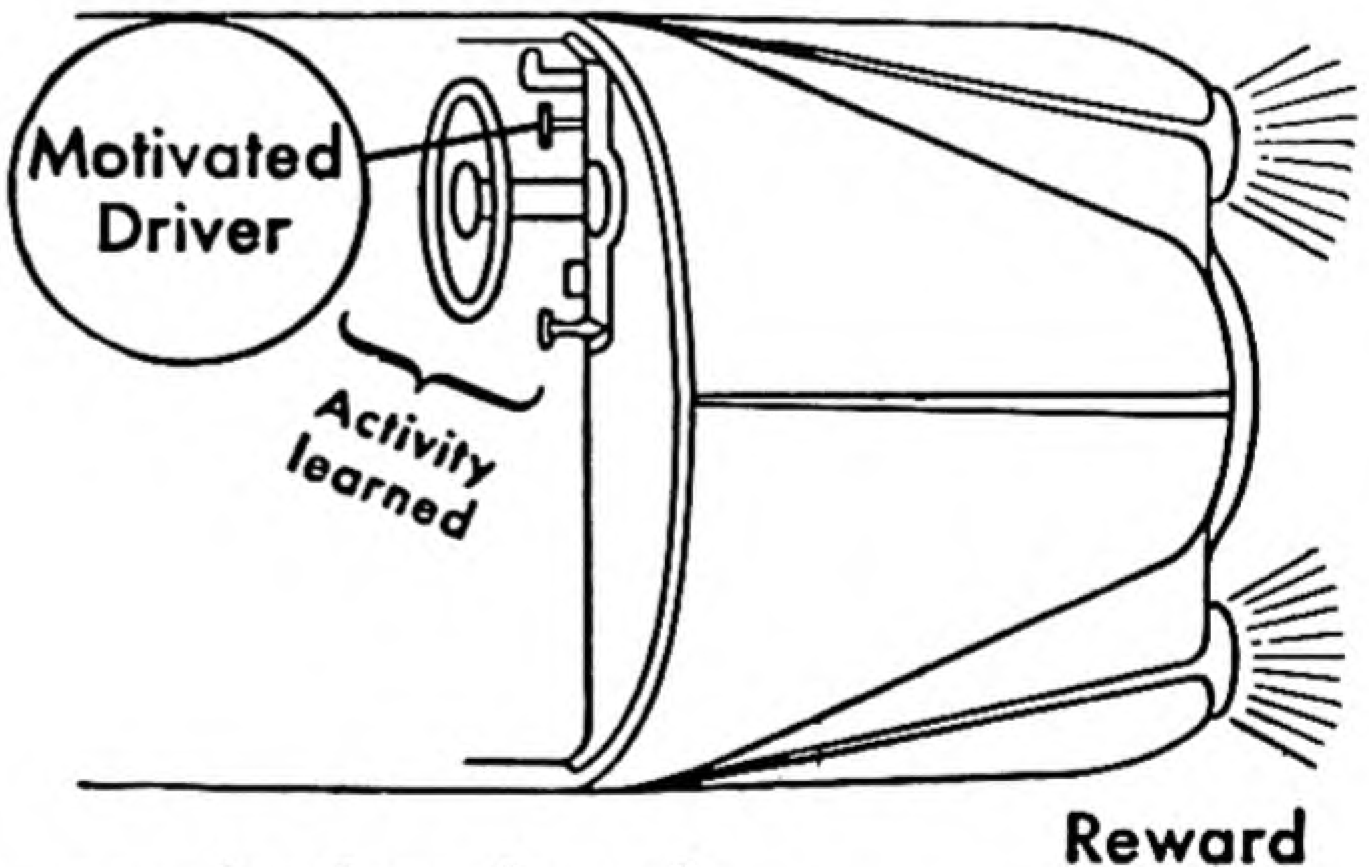


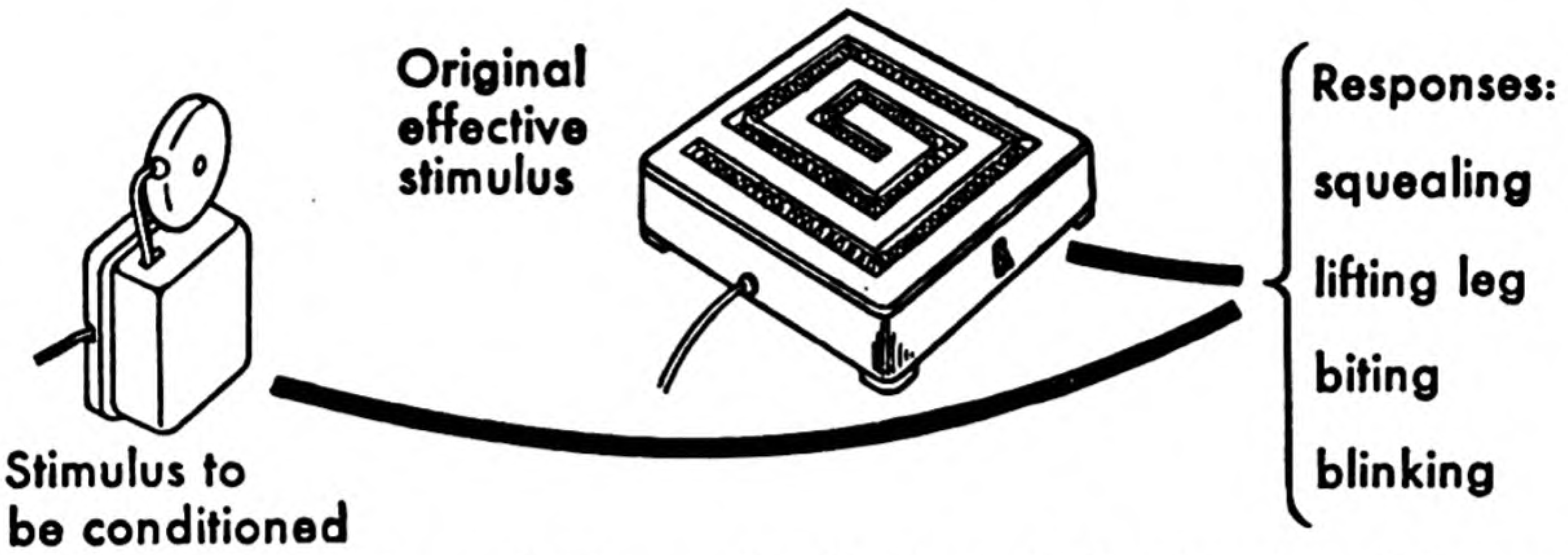
Fig. 60. Variations in activity can lead to learning.

the effect of reducing the organism's tension are likely to be repeated under similar circumstances. Each time the goal is reached and the tension is reduced, a certain amount of *reinforcement* is added to those responses which aid progress toward the goal.

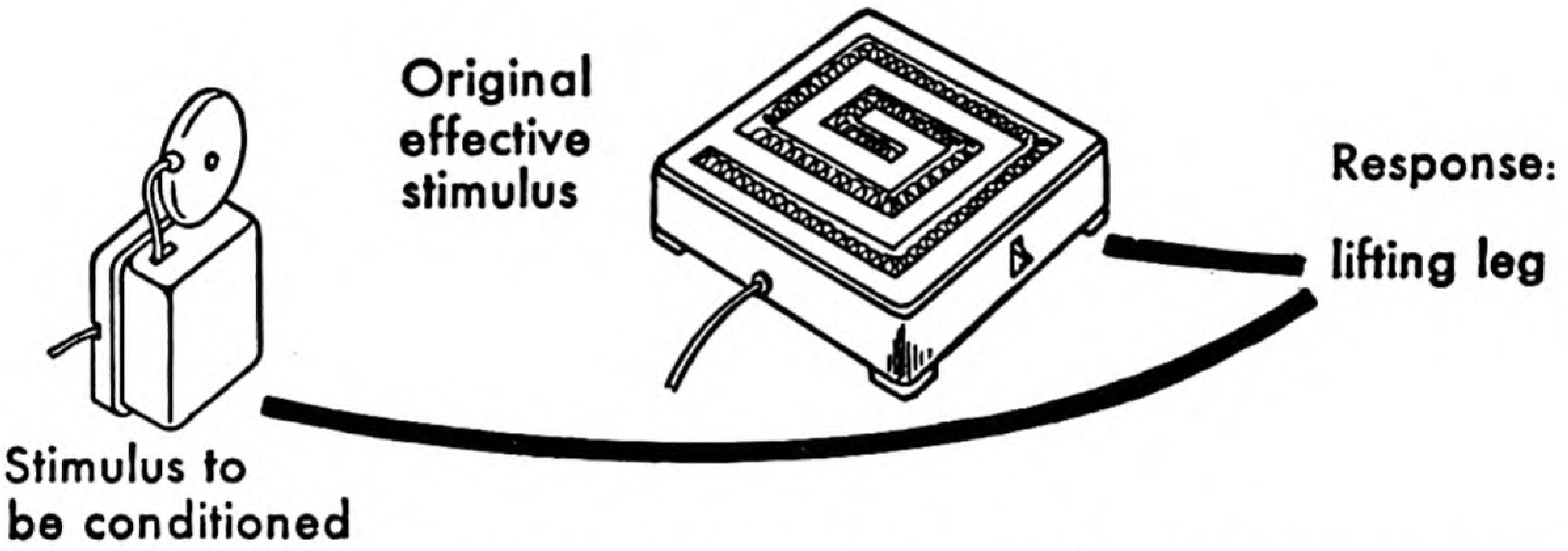
That is all there is to some varieties of learning. If Prof. Yerkes' turtle crawled persistently and continually changed the direction of his crawling, he would be sure to reach the nest sooner or later. If Mr. Stone punched everything punchable, he would be bound to punch the right key eventually. Motivational reinforcement of the more effective acts will do the rest. This is the way rats learn the pathway through a maze to the reward in the food box at the end. At each corner the rat can turn left or right, so the chances are fifty-fifty that his turn will be the correct one. If the maze has four corners and he has 1 chance out of 2 of being correct at each corner, there are 16 possible combinations of turns, so in any one run the eager rat has 1 chance in 16 of reaching his goal. If the maze has eight corners, the rat has 1 chance out of 256 of running it correctly. At first the odds are against him, but if he continues to practice—and he gets no food unless he does—soon the odds are in his favor, and he makes the right combination of turns. In fact no psychologist has ever constructed a maze of this kind that normal rats could not learn in a short time.

There is a catch to it, however. When the task is a complicated one, with many different acts to be performed in sequence, random activity alone will not carry the learning very far. The point can be proved by a little arithmetic. Suppose Prof. Yerkes' turtle, like Don Marquis's cockroach, attacks Mr. Stone's typewriter, trying to write the word "nest" by striking the keys at random, turtlewise. Since there are 43 keys on Mr. Stone's typewriter, the turtle has 1 chance in 43 of hitting any one correctly. After he hits the first one correctly and sees the letter *n*, he has learned one thing. The motivational reinforcement connects that key with that letter. Then he has 1 chance in 42 of hitting *e* at random and learning the next key-letter coordination. Then 1 out of 41 for *s*, and 1 out of 40 for *t*. There are 43 × 42 × 41 × 40 ways of doing all this, so in any one attempt our energetic turtle has 1 chance in 3,361,840 of spelling out "nest." Though we may admire his patience, we cannot say much for his method. It is quite likely that the turtle, or his motivation, will expire before his typing improves at all.

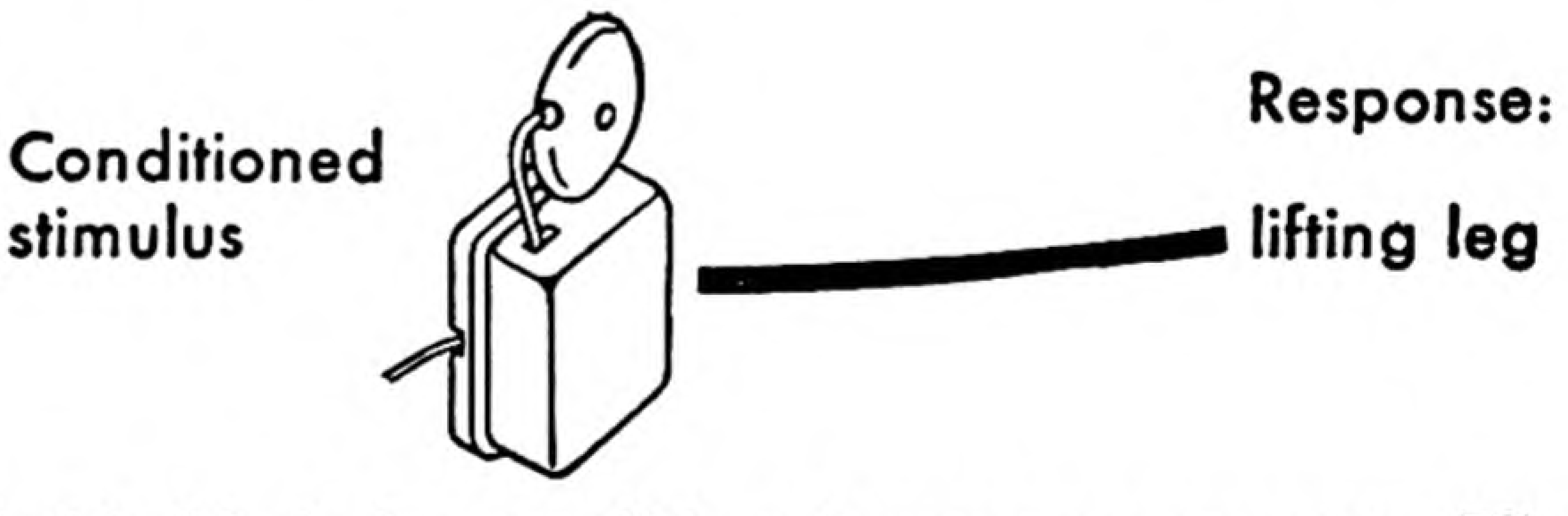
**2. Conditioning.** The terms *conditioned reflex* and *conditioning* were originally technical terms, but they have recently become so popular that they are widely used as synonyms for learning, even by people as far apart as biologists and columnists. Actually conditioning is a special kind of learning, similar to learning by varied activity in the necessity for practice and for motivational reinforcement, but different in that the activity is not variable. In fact the experimental arrangements force the correct response even on the first trial.



Bell is rung and shock is applied to animal's foot. Animal makes defense reaction to shock, one part of which is lifting his leg.



Animal calms down, resigns himself to the fate of a laboratory animal. Most of the defense reaction is eliminated, but he continues to lift his leg when the bell is rung lest he get another shock.



After a little training of this kind the conditioned response appears. The animal lifts his leg when the bell rings, even though the shock is not applied. Something new has been added to the animal's repertoire. But the conditioned response will be extinguished unless it is occasionally reinforced by the shock.

Fig. 61. The conditioned-response route to learning.

Although many conditioning experiments have been performed since the phenomenon was discovered by the Russian physiologist, Ivan Pavlov, and many complications have been introduced, the essence of the procedure is simple. If we wish to train an animal, a sheep, let us say, to lift his right foreleg when a bell rings, we could watch him for several hours, ringing the bell now and then, hoping that he will lift his foreleg for some reason or another, and reward him if he does so. But a much more efficient procedure is to build the motivation right into the situation. We shall shove an electric grid under the sheep's foot and give him a shock immediately after we ring the bell so that, as far as the sheep is concerned, the hot foot and the bell always come together, as part of the same situation. Conditioning works best when the bell (the stimulus to be conditioned) is rung a half second or so before the current is turned on in the hot plate (the original unconditioned stimulus). The bell becomes a signal for the hot foot, and the sheep soon learns to raise his foot, or else.

This all sounds highly artificial, like a scientist's plaything. But any amateur psychologist, with an analytical twist, can see all around him every day the same special sequence of events that produces conditioning in the laboratory.

A farmer puts up an electric fence. Promptly his curious Jersey cow gets stung on the nose. Just before she *feels* the sting, she *sees* the fence. Henceforth, by conditioning, the sight of the fence is sufficient to keep the cow away from the fence. Only occasional reinforcement by the sting is necessary.

Mrs. De Giacomo makes herself a cup of coffee and drinks it. When the caffeine is absorbed into her tissues 20 or 30 minutes later, she feels peppy. She goes through this sequence again and again. Then she notices that the peppy feeling comes immediately after smelling the coffee and tasting it, before the drug has even reached her stomach.

Mrs. De Giacomo's youngest crawls into the kitchen and spies the family cat. He reaches out to pat the cat. At that moment Mrs. De Giacomo lets the oven door slam, scaring her child, and the cat, and herself, and causing a general domestic disturbance. For some time afterwards, whenever the child sees the cat, he is scared and cries.

Conditioning has been used in a practical way also, as in the treatment of bed-wetting. Most children are awakened by tension in the bladder, presumably because of stimulation of somesthetic receptors

(see page 71) in the bladder walls. Bed-wetters sleep through this stimulation, however, so the problem is to make the bladder tension an effective stimulus for waking. A pad is placed under the child and suitable electrical connections are arranged so that when the pad becomes wet, a circuit is closed and a bell rings. This ringing of the bell (the unconditioned stimulus) wakes the child and he is taken to the toilet. But the bladder tension (the stimulus to be conditioned) always precedes the bed-wetting, so after a few trials, the bladder tension is conditioned to awakening, and the child gets up *before* he wets the pad. At least the method has worked in most of the cases on which it has been tried.[2]

Scientists who work with animals find the conditioning process a valuable technique for controlling the animals' reactions. In testing a rat, for example, how can one tell whether he hears a tone or not? One ingenious method is to condition the animal to make a certain response every time he hears a sound. To begin with, rats will automatically squeak when given a mild electric shock on the tail (the unconditioned stimulus). Now if a tone (the stimulus to be conditioned) is sounded near the rat's ear just before the shock is administered, the rat becomes conditioned, after a few trials, to squeak whenever he hears the tone, even without the shock (see Fig. 62). Once the tone is established as a conditioned stimulus for the squeaking response, the intensity of the tone can be lowered until the rat will no longer squeak, and thus his threshold can be determined. Or the frequency of the tone can be changed, and the rat's threshold can be tested at different frequencies. By careful experimentation of this sort Cowles and Pennington[3] were able to show that human beings can hear better than rats at frequencies below 6,000 cycles per second, and that rats can hear better than human beings at frequencies above 9,000.

These are all examples of conditioning. If one stimulus is able to evoke a certain response, another stimulus regularly heard or seen or felt just before it rides in on the influence of the first, and soon the second is calling forth almost the same response as the first. The general's car rates a salute, even without the general, by the same mechanism.

Conditioning is a primitive property of the nervous system, really nothing to be proud of. Brainless cats and dogs can learn new things by this process, in a crude way at least, so some of the conditioning

must take place in the spinal cord.[4] The next step in the persistent search to uncover the fundamentals of learning will be to follow these events right down to the nerve cells themselves. Already some psychologists are dissecting out the nerves and muscles that produce the new responses and attempting to detect the first timid beginnings of the conditioned response under a microscope.[5] With modern electronic, chemical, and psychological wizardry brought to bear on the individual nerve cells and the junctions between them, sooner or later the nervous system will be forced to give up its secrets.

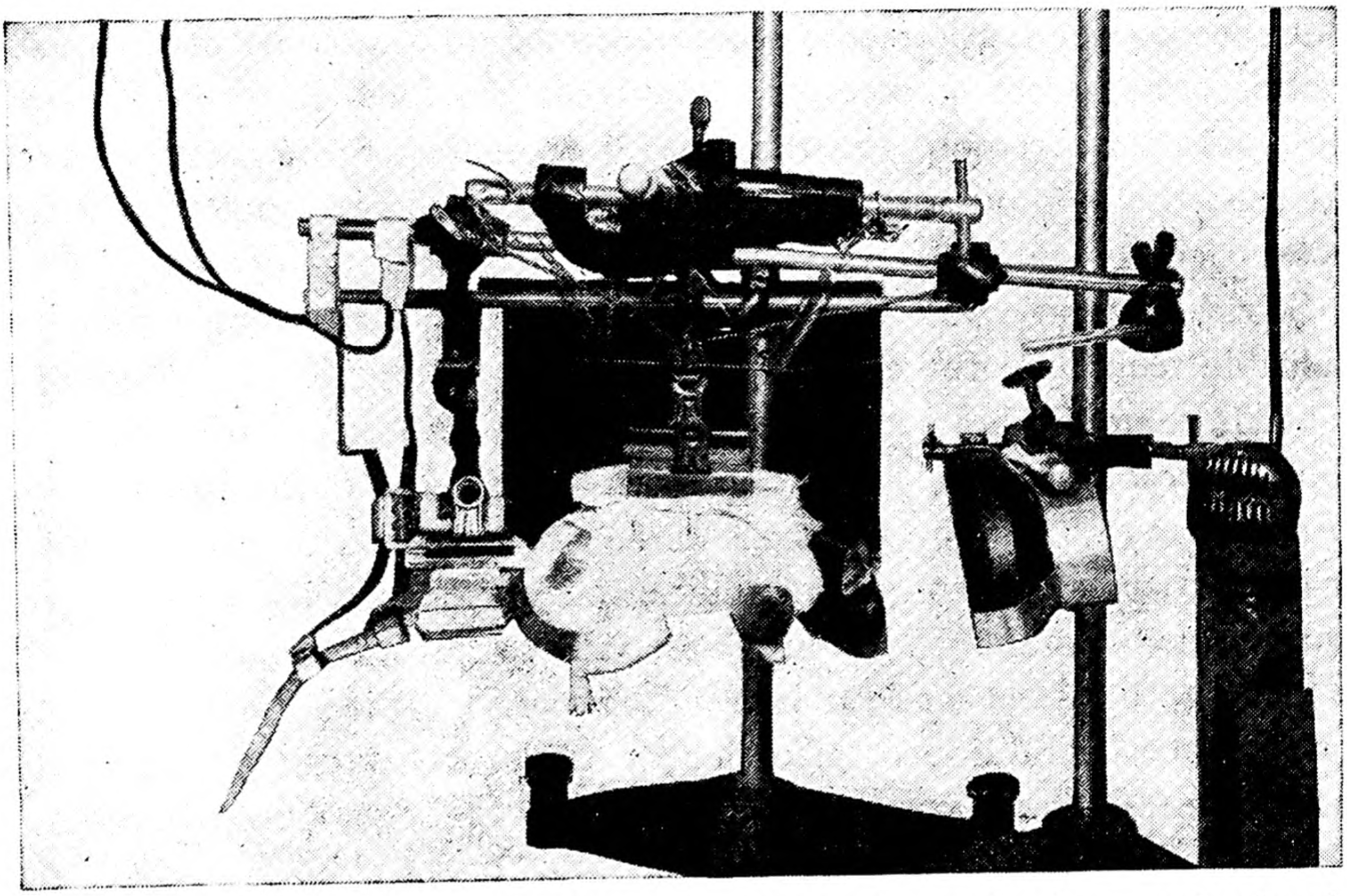


Fig. 62. Conditioning apparatus. The unconditioned stimulus is a weak electric shock applied to the rat's tail. This produces a squeaking response, which is picked up by the microphone at the right. The conditioned stimuli are sounds made by the telephone receiver directly in front of the rat. After the rat has been conditioned to squeak when he hears the sound, the sound can be systematically varied in intensity and frequency in order to determine the rat's thresholds. The entire apparatus is enclosed in a soundproof box. (*Courtesy of J. T. Cowles and L. A. Pennington.*)

Although conditioning may, under special conditions, be a very simple process, which takes place in the spinal cord or lower parts of the brain, in most cases higher brain functions are involved. A person who anticipates being conditioned learns better than one who is set against it. Distractions in the laboratory interfere with the conditioning

of animals. Whatever part of the nervous system is modified in conditioning, the process can occur only when the nervous system as a whole is suitably integrated, when the conditioned response fits in with the organism's over-all activity of the moment.

**3. *Learning by organization.*** Learning by doing is an active red-blooded way to learn. But in many of life's trials and tribulations, and in many of the situations that psychologists arrange for their laboratory subjects, new responses are acquired, not so much by varying one's activities as by the organization or reorganization of material already at hand. Some of the principles of perceptual organization, by which stimuli reaching the sense organs are organized into patterns, have been described in Chap. 6, and most of these principles apply also to the organization of material taken in by the organism at different times. When the sensory material is organized into a pattern immediately, the process is called perception. When the organization requires practice, and takes place over a period of time, the process is called learning.

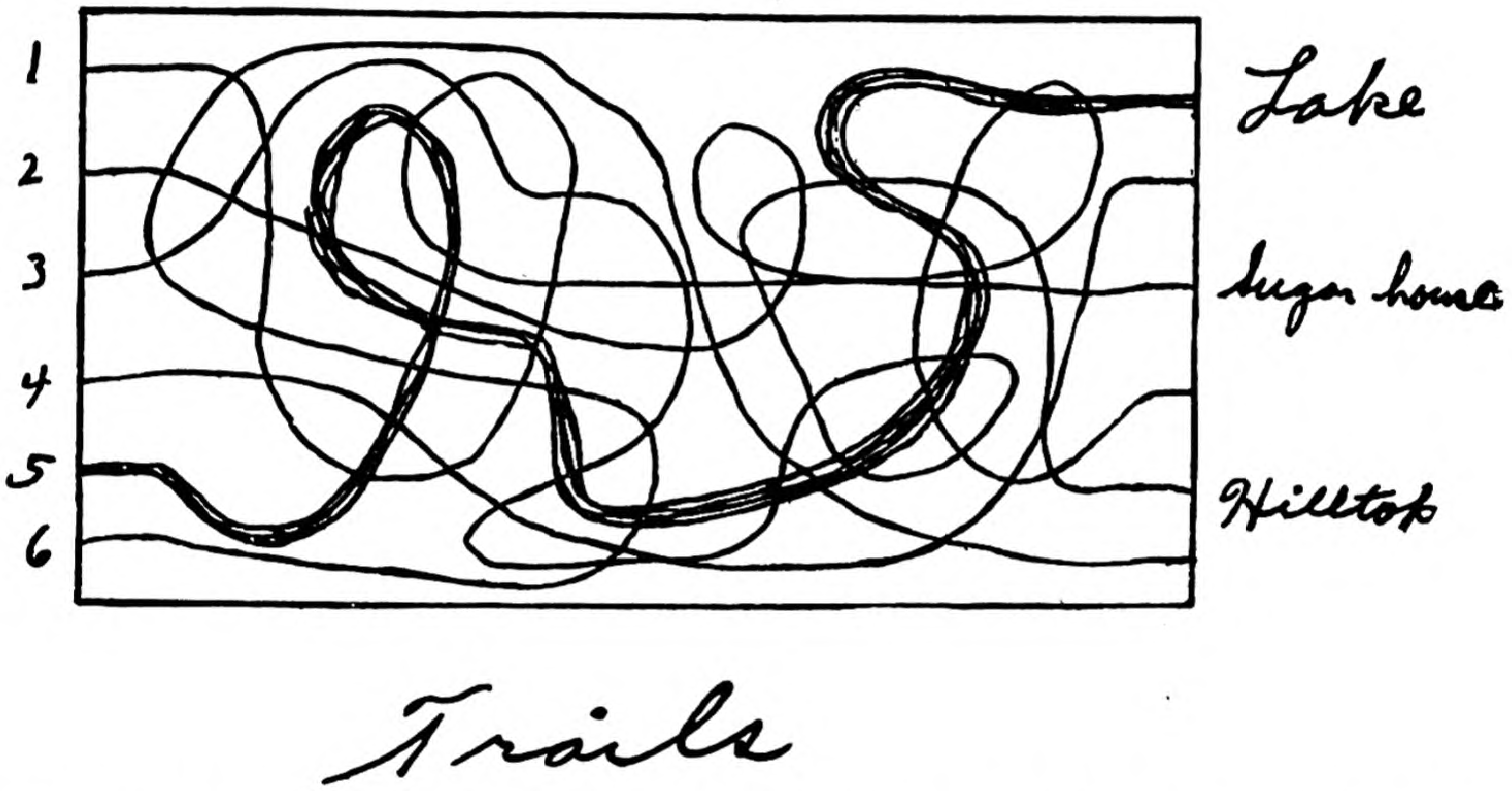


Fig. 63. An example of perceptual learning. Which trail leads to the hilltop?

For an example of this kind of learning look at Fig. 63, in which the task is to begin at the left and learn the trail to the hilltop. The correct trail is all in sight, but so are five other trails; hence the learner has to organize what he sees and make the hilltop trail stand out from its entanglements, as the lake trail does.

Another illustration of learning by organization is furnished by the foreigner who comes to the United States and goes to a football game for

the first time. At first the activities on the field will appear completely unorganized. Young men in gay carnival costume hurl themselves forward, backward, and sideways, then suddenly they all stop and walk leisurely back and forth. Whistles blow from time to time, the crowd yells, and the proceedings make no sense at all. But, as he watches the game, he may begin to see a pattern in it all. The bursts of activity have a beginning and an end, which are related somehow to the advancement of the ball. The general outlines of the play become clear to him after a while, then he notices additional details, like the gestures of the men in zebra suits and the location of the linesmen and their markers. If he goes to another game —as he probably will—he may perceive how all the part-activities have their place in the pattern of the whole. Understanding of the relationship between parts of a pattern, between the referee's whistle and the stopping of play, for example, is called *insight.* Use of such understanding to acquire further knowledge is called insightful learning or *learning by insight.*

People learn many complicated patterns of activity and of knowledge by working out the relations between means and ends, discovering what they have to do to get what they want. Mr. Stone, instead of trying all the rods, buttons, and switches to find the one which turns on the lights (see Fig. 60), could trace the wires from the lights back to the instrument panel, *i.e.,* instead of learning by trial and error he could learn by insight.

Learning by trial and error and learning by insight usually go together in any complex human enterprise. Consider Mr. Stone's progress, after he moves to the suburbs and has to learn the shortest route from White Rock Heights to his jewelry store downtown. He will not, like Professor Yerkes' turtle, take every road he sees. He has a general picture, vague though it may be, of the relationship between his home and the store, so he tries only those roads which seem to lead in the right direction. He not only goes somewhere, but he sees where he is going. In fact, since our Mr. Stone is not a man to waste time or gas, he will probably pick up a map at the nearest filling station. The more he learns about the lay of the land from studying the map, the less he has to learn by varying his activity. It works the other way also. The more he explores the roads, the more insight he acquires into the relationships between the roads. For insight comes from hindsight as well as foresight.

**4. Social interaction.** Learning is an individual affair, the residues of one's personal history, filed away in one's own nervous system. But

much of what one learns is intrinsically social: how to communicate with others, what to wear to a funeral, the rituals of the law, the church, and the lodge, and how to show sympathy. And, whatever it is that is learned, the learning of it is usually a social process, for in most cases the acts, ideas, and emotions that are practiced come originally from someone else. Children do not learn arithmetic, language, or moral standards by trial and error, nor by organization. They learn to do what they are told to do. Along with such individual mechanisms as varied activity, conditioning, and learning by organization, which offer up the material to be practiced, should go such social mechanisms as instruction, imitation, and suggestion, performing the same function. Everyone recognizes the role of parents and schools, not only in teaching children, but also in selecting, from a wide range of possibilities, those things which they believe the children should learn. In a less conscious way, what children learn is determined by older children and adults through the process of *imitation.* Although our language has a verb "ape," which is synonymous with "imitate," and although we are fond of such epigrams as "Monkey see, monkey do," imitation is not at all common among infrahuman animals. Only recently, when psychologists have set up ideal conditions in the laboratory, have they been able to get apes to imitate one another. And human infants, up to age two, imitate very little. But after imitation does begin, usually during the third year, things begin to happen. A large share of a youngster's development can be traced to imitation of his parents, an older brother or sister, a schoolteacher, or some other adult. The imitation may be quite superficial, as when one girl imitates another's way of tying shoelaces, or it may be a wholehearted *identification,* as when a boy models his speech, his manner of walking, his clothes, and his choice of pets after the current movie hero. It is a general rule, which will be useful in later chapters on the development of personality, that children, and adults as well, are most likely to imitate, or identify with, or accept the suggestions of, those people whom they respect, usually those people who occupy a prestige position in society by virtue of real or apparent achievement in business, athletics, warfare, or beauty contests. Children and adolescents often shop around among the heroic models offered by movies, radio, books, and personal contacts, adopting only the mannerisms and suggestions that are reinforced by their own pattern of motives.

## SUMMARY THUS FAR: COMMON FEATURES OF ALL TYPES OF LEARNING

These four ways by which new patterns of response are acquired, though they are similar in some ways, all have special features of emphasis that have led psychologists to treat them separately. Learning by varied activity takes place in a complex situation where the organism does many different things, some of which are reinforced by their relation to the goal response, while others are not. In conditioning, the emphasis is on precise arrangements of stimuli and response. Forming new patterns of the data at hand is the chief feature of learning by organization. Social interaction stresses the source of the responses that are acquired.

In spite of these features of emphasis, the four types of learning overlap in several respects. The similarities as well as the differences should be studied. To begin with, the situation in which the new responses are acquired is important to all four types. All are alike in that they occur only in complex situations for, if the situations were simple, there would be nothing to learn. Learning by organization is similar to learning by varied activity in that the perception or comprehension of the situation is varied. A person looks at, or views, or understands, the situation one way, then drops that as unrewarding and tries another, finally learning the one which is reinforced. In conditioning, while the response may be variable at the beginning (see Fig. 61), the situation is such that one special response is evoked from the outset, tied to a new stimulus, and then the coordination is reinforced by the experimental arrangements. Other laboratory arrangements have been invented in which the animal's response is only slightly variable, as when a rat is placed in a box containing nothing of interest except a lever. If he presses the lever—and most curious rats will—he gets a reward, and because the reward and the act to be learned are closely associated, he learns very quickly to press the lever when he is hungry. This procedure, intermediate between typical conditioning and trial-and-error learning, is called *instrumental conditioning*.[6] Learning through social interaction occurs, like the other types, in complex situations, but the response that is acquired is initiated, not by the learner's activity, nor by the arrangements of the apparatus, but

through the activities of other people. The learner may, of course, shop around, imitating several people in turn before settling on some course of action that is rewarding to him.

All kinds of learning are alike also in that some activity of the organism is necessary. Learning is never a passive process, for it is only by activity that new response patterns are integrated—though the activity may be of a highly intellectual sort, as in learning new ways of organizing scientific knowledge, or of a reflex sort, as in conditioning. Right here is where we see the importance of motivation in learning by varied activity and social interaction. People learn more when they are well motivated in active pursuit of a single goal than when they are dashing off, bewildered and distraught, in several directions at once. The motivation establishes a general pattern of activity, more or less integrated at the outset, into which specific acts, ideas, or emotions can be further integrated if they are reinforced by relationship to the goal response. In the case of conditioning, the activity does not necessarily involve the whole organism; it may be of a localized reflex sort, for example, the eyelid reflex, and the integration may take place at a low level of the brain or in the spinal cord. In learning by organization, the activity may be predominantly cerebral or intellectual, with very little outward manifestation. Motivation is necessary for learning a new organization, nevertheless, for if one view of the situation is as rewarding as another, no reorganization will occur.

Just because the activity behind the organization of new relationships within the situation is of an intellectual or "mental" sort, the motivation is often obscure. People learn much more than they intend to. In walking to the drugstore, for instance, our friend Stone not only learns where to turn right and left, as we would expect, but he also learns something of the total situation along the route. He locates buildings and cracks in the sidewalk, hears the characteristic sounds of the neighborhood, smells that unique drugstore blend of disinfectants and toilet water, and builds all these events into a familiar pattern. During one ordinary lifetime a person picks up an astonishing range of information and many habits, attitudes, and social skills by this process of *incidental learning*, but it is true, nevertheless, that the learning is more effective the less incidental it is, the more clearly the material to be learned is centered in the focus of his attention, and the more closely it is tied in with his dominant motivation. A person does not

learn much about the cracks in the sidewalk or the buildings along the way. He learns just enough so that he can proceed about his business, without stubbing his toe or walking into the wrong entrance. If he learns more than is necessary to further his activity of the moment, it is probably because of the exploratory drive (see page 19), a primitive tendency to orient oneself to the lay of the land, to grasp enough of the environment that one will be prepared to jump to safety and to avoid stumbling over obstacles. The confusion of being in a fog, for example, makes one fearful and restless, until he straightens himself out with the world and learns where he is and where he is headed. All the motives mentioned in the preceding chapters, and several others that are not well understood, initiate and control the activities of men and animals, forcing them to learn something or other. And every complex activity of a socialized human being is affected more or less by all of these motives.

Perhaps the most important of the common features in all kinds of learning is the tendency to generalization. When Mrs. De Giacomo's youngest acquired a conditioned fear of the family cat by the unfortunate domestic disturbance in the kitchen, Mrs. De Giacomo got rid of the cat and bought a little puppy. But the puppy also frightened the child almost as much as the kitten. Furthermore, the child showed signs of fright when the Stone boy from the next block brought in his pet rabbit to entertain the youngster. For such is the nature of the nervous system that the effects of practice are widespread or *generalized* rather than specific; a response tied to one stimulus will be evoked by other similar stimuli. As these new coordinations between stimulus and response resulting from generalization are practiced in different contexts, they are reinforced or not, like anything else, according to their effectiveness in furthering the individual's activity of the moment. Suppose Mr. Stone wants to set the hand brake in his new car. Generalizing from the old one he reaches out with his left hand—and touches nothing. For the designers have cunningly concealed the handle between the steering column and the radio. Since this generalization is not reinforced in the new situation, it will soon be abandoned. This limiting of the spread of the effects of practice, called *differentiation*, is the other side of generalization.

Because these four types of acquisition of new response patterns have

so much in common, attempts have been made to interpret all learning as resulting from varied activity with differential reinforcement, or from conditioning, or from organization and reorganization. The outcome of such fascinating and ambitious theoretical enterprises is still in doubt.

## THE COURSE OF ACQUISITION

The essence of learning is the change that takes place as a result of activity, so in order to prove that some learning has occurred, it is necessary to test the learner at least twice, before and after practice, as shown in Fig. 58. But, if we wish to follow the course of learning and chart the ups and downs of the learner's progress, it is necessary to test him often. When this has been done and the score for each test tabulated, a learning curve can be constructed, showing his progress graphically, as in Fig. 64. It is customary to draw these curves so that the base line shows the independent variable, *i.e.*, the amount of prac-

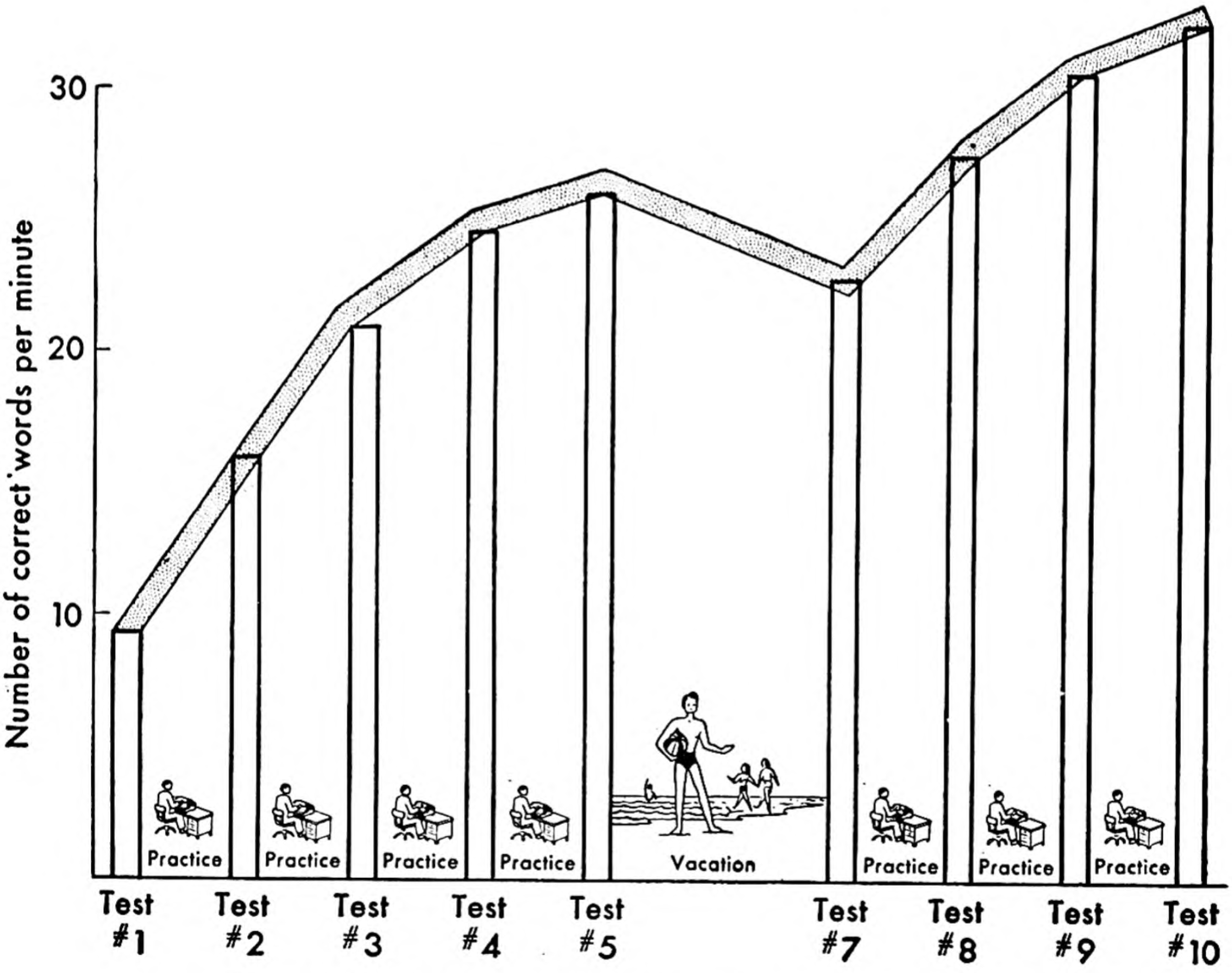


Fig. 64. David Stone's improvement with practice.

tice, and the vertical line or ordinate shows one of the dependent variables, which may be the number of errors, number of successful or correct responses, time required, or some other measurable aspect of behavior. Over a period of 20 or 30 years, many such learning curves have been analyzed by psychologists, and a number of interesting phenomena have been turned up.

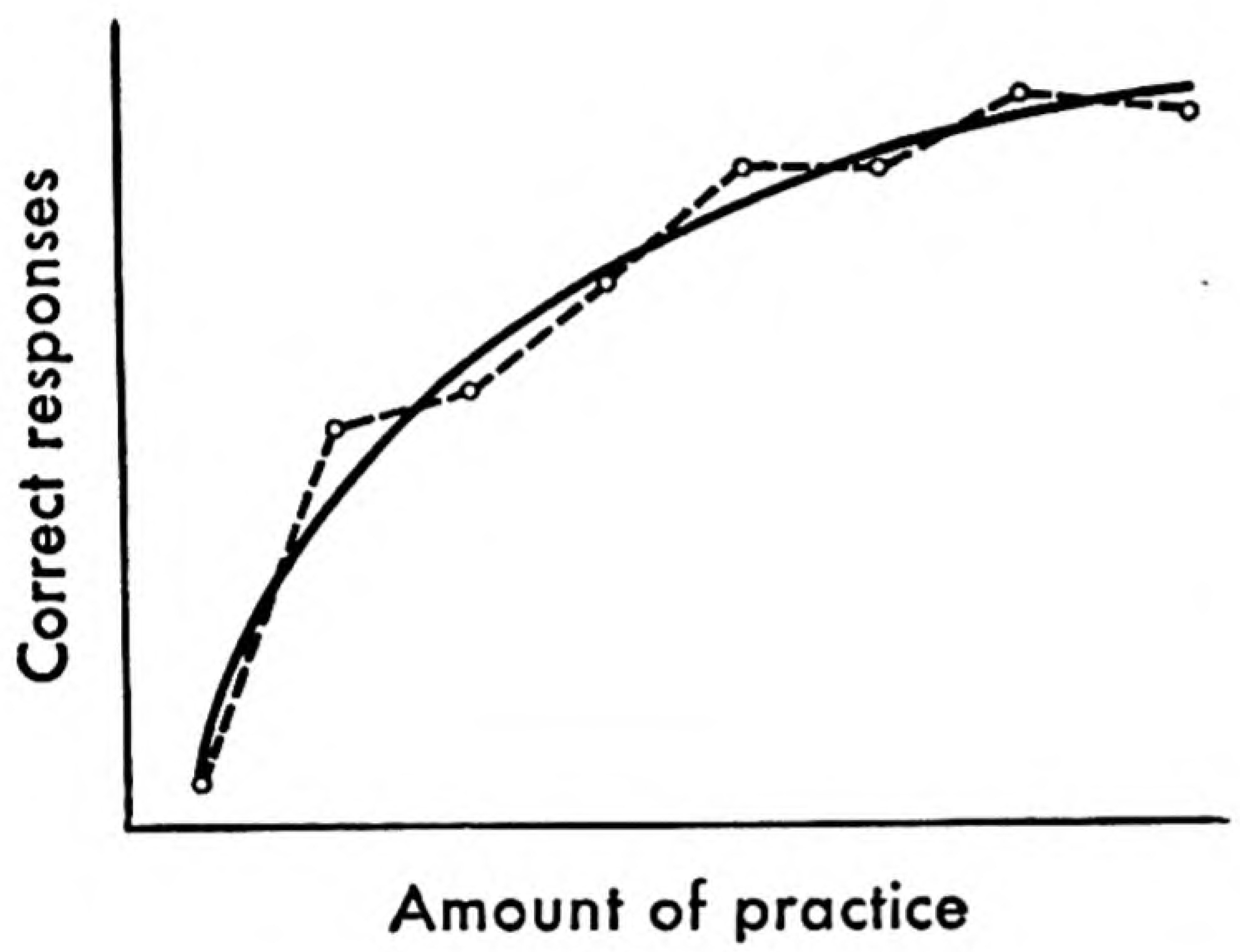


Fig. 65.

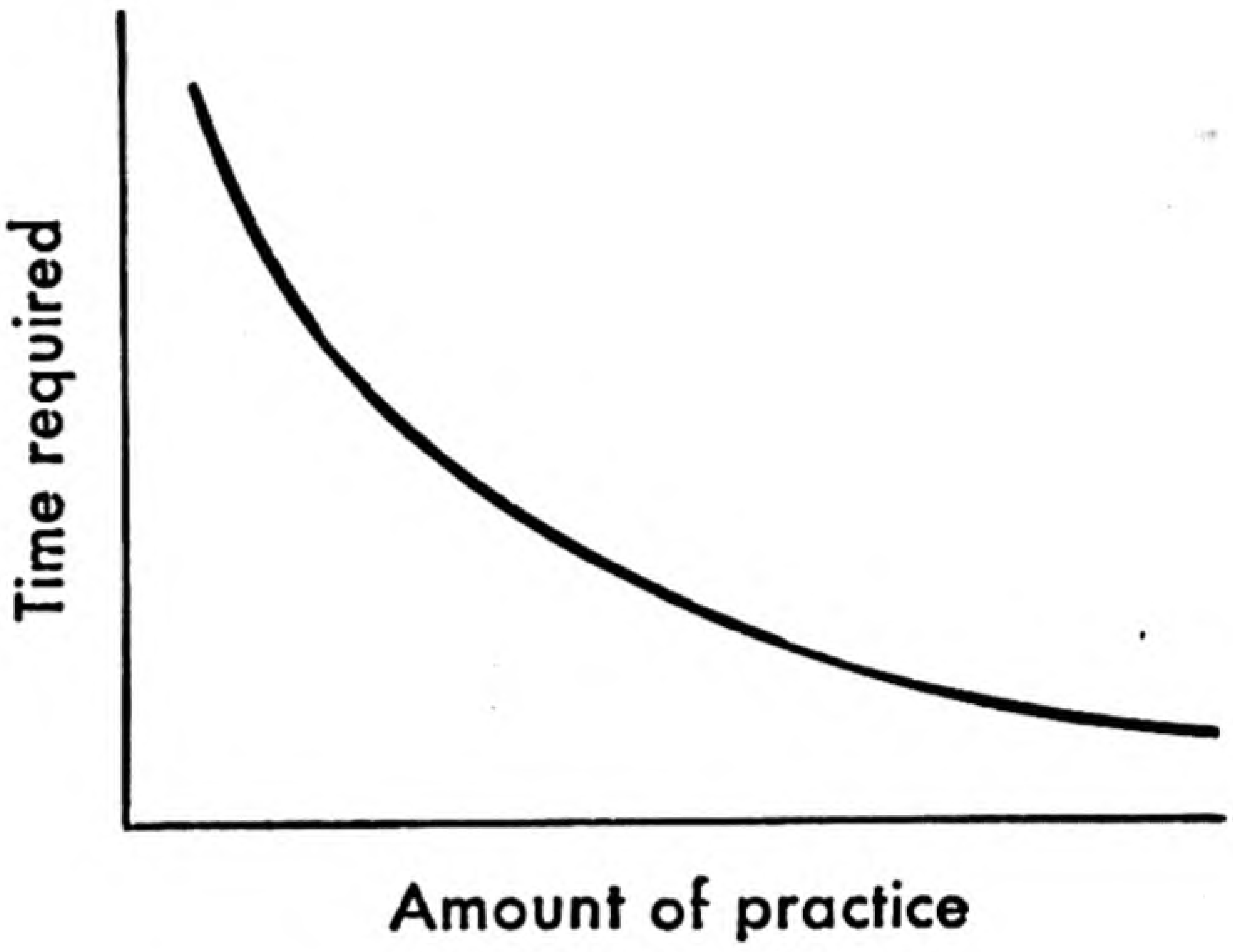


Fig. 66.

Fig. 65. Learning curve showing negative acceleration. The points connected by the broken line indicate the actual number of correct responses as the learner improves. The solid line is drawn to smooth out the irregularities and emphasize the general trend.

Fig. 66. Learning curve showing negative acceleration. When time is recorded rather than number of correct responses, the curve falls as the learner improves. If this curve were inverted, it would look like Fig. 65.

Most learning curves show irregular progress, with many ups and downs, as shown by the broken line in Fig. 65. Human behavior fluctuates in efficiency from moment to moment and from day to day, for the same reasons, outlined in the first chapter, that the performance of any complex mechanism fluctuates. For one thing, the learner's physical fitness varies with loss of sleep, the state of his glands and his digestion, as well as many other variables. He may stop practicing for a while, with the results illustrated in Fig. 64. Or, what amounts to the same thing, he may lose interest for a short time, practicing with one eye on the clock. Or he may have moments of unusual efficiency, when everything goes his way. If these *random fluctuations* do not show any consistent trend, they are not of any particular importance, either theoretically or practically.

When these minor fluctuations are disregarded and the general trend of the curve, as shown by the heavy line in Fig. 65, is studied, usually we see a curve of diminishing returns or *negative acceleration.* Progress is relatively rapid at the beginning and relatively slow near the upper end. There are exceptions, but this type of learning curve can be taken as the most common. If the task has many parts to be learned, one of the reasons for the slowing down of progress as learning proceeds is simply that the learner does the easy things first. The other reason is the effect of a limit of improvement at the upper end, whether due to a *physiological limit* established by the sheer inability of the nerves and muscles to respond with greater speed or precision, or whether by a lack of motivation to do any better, or simply because there is no more to be learned. When the learning of a simple task, like hitting a telegraph key or sorting cards into five pigeon holes, is measured in terms of time, the curve is nearly always one of negative acceleration, as shown in Figs. 65 and 66, the shortest possible reaction time being the physiological limit.

Modern analysis of progress in learning, directed toward uncovering the essentials of the process, is a highly technical mathematical enterprise. For those who like to look at these matters mathematically here is a simple—in fact, an oversimplified—example that shows how the rate of learning is affected by nearness to the upper limit.

Let us begin with the case of a woman whose maximum rate of typing, after several months' practice, is 60 words per minute. Before any practice at all her rate was zero, of course. When the first test was given, after 1 month of concentrated practice, she could type 20 correct words per minute. At the second test, 1 month later, she was up to 33, in another month she hit 42, and then 48, and so on. Such progressive improvement is not, as many might suppose, an unpredictable phenomenon. In fact it is easy to uncover a simple law that describes her progress.[7]

The law states that her improvement during any practice period is a certain fraction, in this case one-third, of her potential improvement. Since her upper limit is 60, at the beginning her potential improvement is 60. During the first month of practice she picked up one-third of this, or 20 words per minute. That left 40 to go. In the next month she picked up a third of this 40, or about 13 words per minute, which, added to her 20 from the first month, makes her total rate 33. Now she is still 27 from her top speed. One-third of this is 9, so she ought to be able to do 42 words

per minute at the end of the next practice period (for 33 + 9 = 42). By a little pencil work one can see that if she goes along with the same uniformity, her rate 1 month later will be 48 words per minute (for 60 − 42 = 18, while one-third of 18 is 6, and 42 + 6 = 48). And so it goes, as in the curve of Fig. 67. A month later, if all conditions remain constant, the law states that she will hit 52 words per minute, which is not bad. She can now get a job working for David Stone, whose interest in self-improvement on the typewriter has gently relaxed.

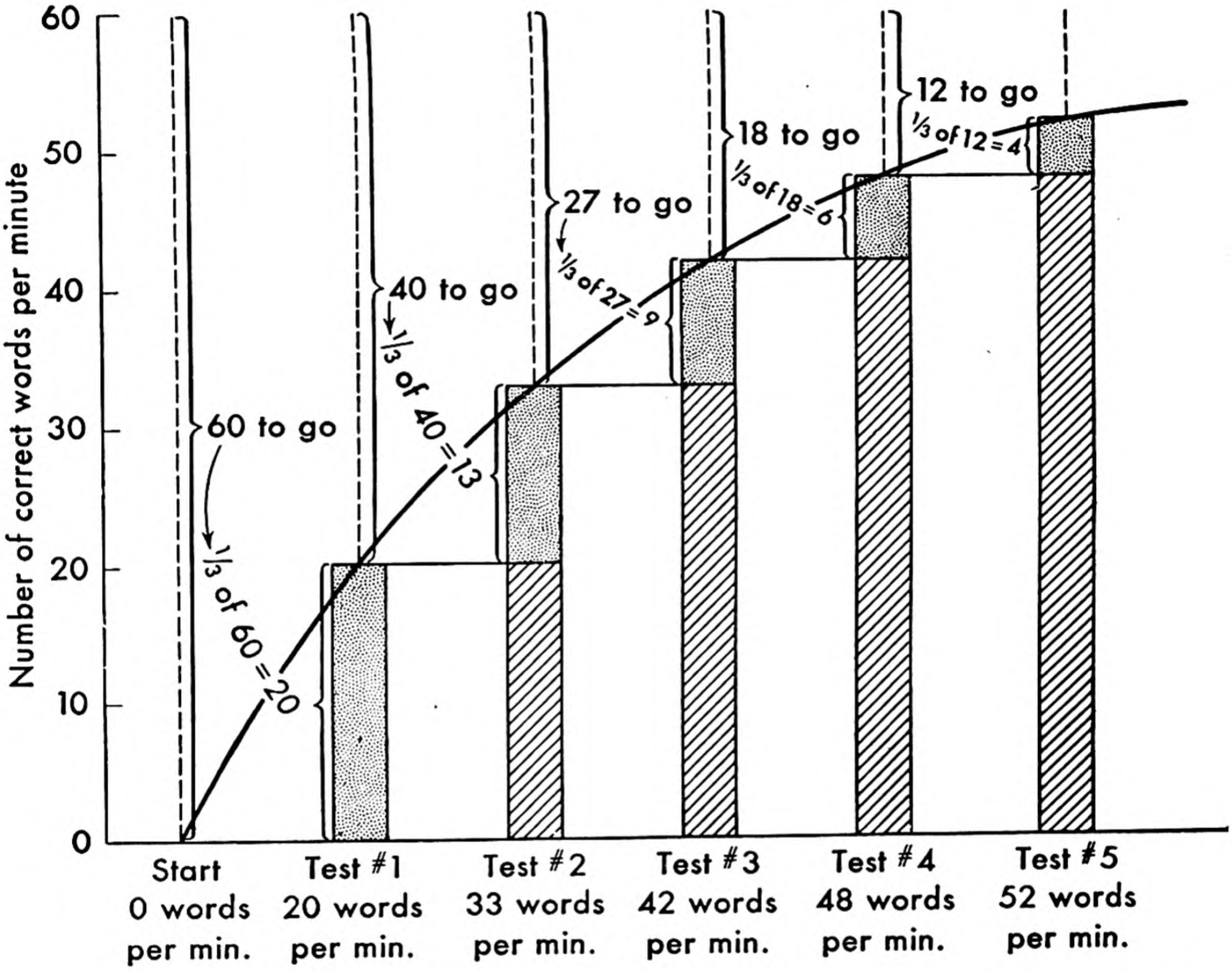


Fig. 67. The arithmetic of improvement with practice. This chart is made up to illustrate how modern psychological theory attempts to find general mathematical laws underlying the complicated behavior of living organisms. In this highly oversimplified example the whole curve can be understood if it is assumed that between each test and the next the typist progresses one-third of the distance toward his limit. See text for further explanation.

This is an artificial example, to be sure, but not extremely artificial. Regular, lawful change from one condition to another is more common in nature than disorderly change. The growth of bacteria in a small dish of blood follows a law like this one, for the same reasons. After

the bugs get started, their rate of development is proportional to the amount of space and food available. This amount available to new bacteria is progressively diminished by the presence of those already grown. So the growth rate slows down just about as our typist's rate of improvement slows down. It takes many, many words to describe these regularities in human and animal behavior. The mathematical theorists, who are in the forefront of progress in psychology, could

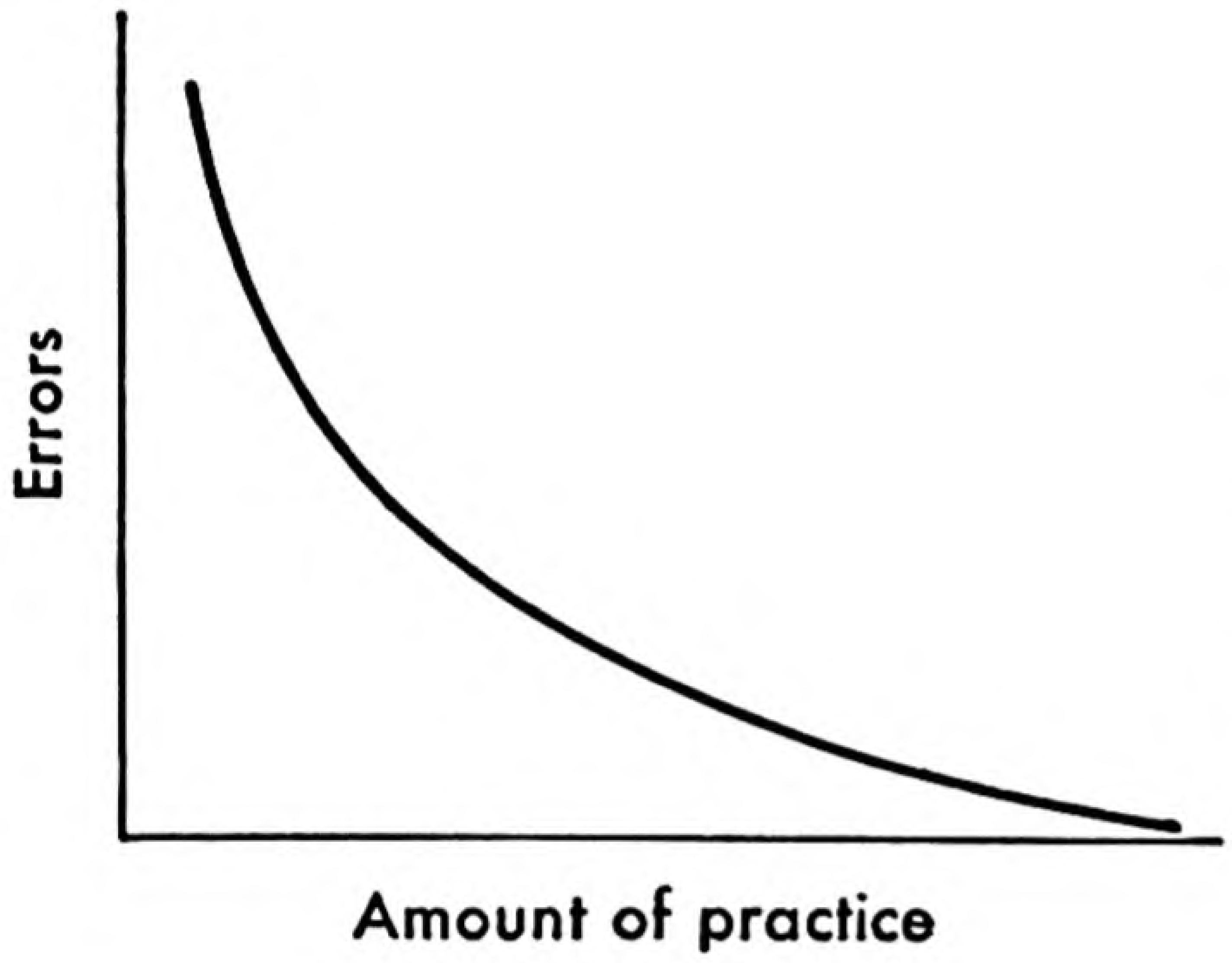


Fig. 68.

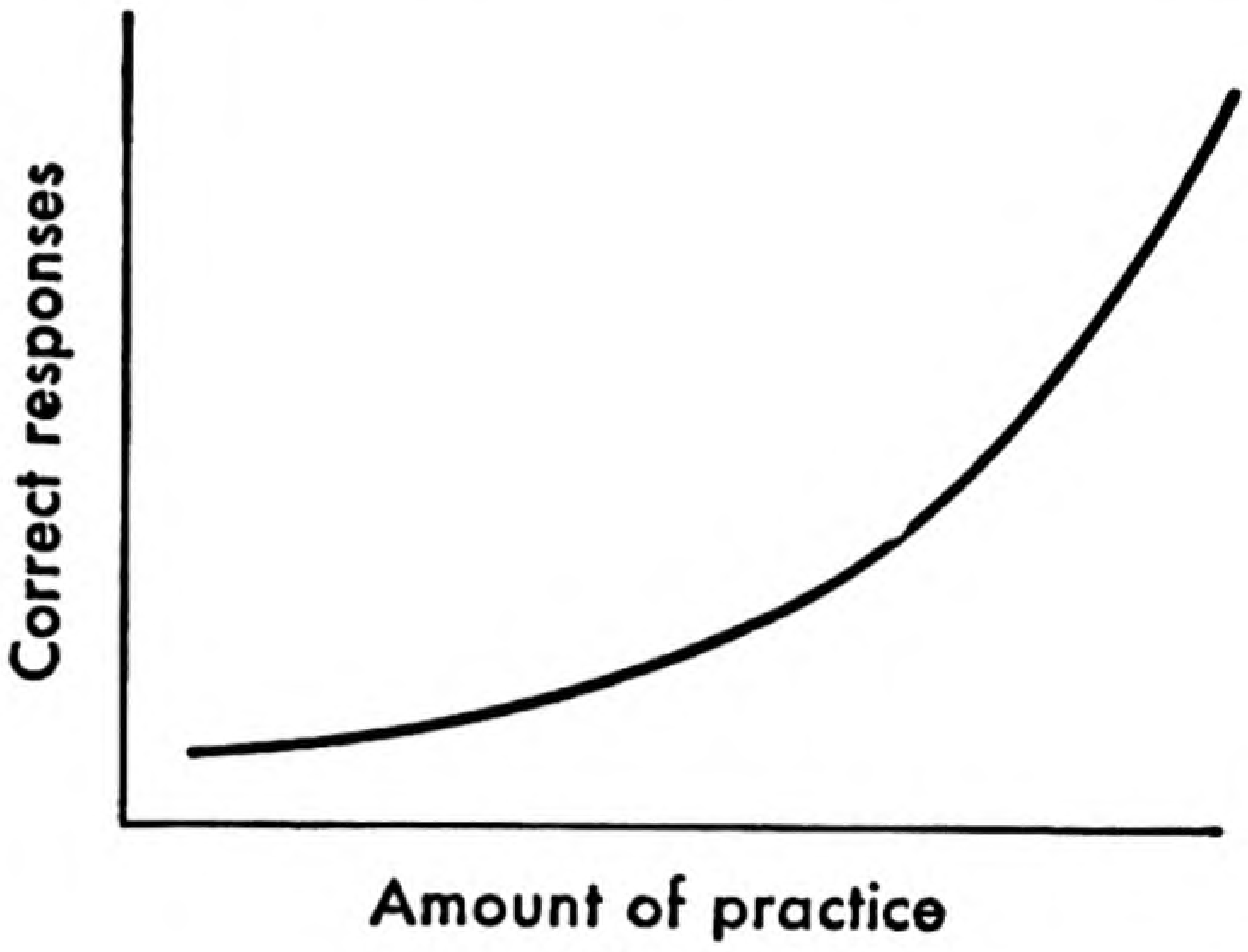


Fig. 69.

Fig. 68. Learning curve showing negative acceleration. If learning is indicated by number of errors made, the curve will usually fall as practice continues.

Fig. 69. Learning curve showing positive acceleration, to be compared with Fig. 66, which shows negative acceleration. Under some conditions, described in the text, rate of improvement increases with practice and the curve bends upward. Such curves are rare, but see Fig. 80.

say it all much more elegantly by writing $W$ for the number of words typed per minute, and $N$ for the number of practice periods, and wrapping up our typist's improvement in one neat little package:

$$W = 60 - \frac{60}{10^{0.1716N}}$$

A few learning experiments have given evidence of increasing returns from practice, or *positive acceleration*, as shown in Fig. 69. Such encouraging progress may occur simply because the learner does the hard things first and then picks up speed on the easy ones. Or he may learn some tricks in the early stages of practice that help him in the later stages. This is especially likely if the task is a complex one that can be learned by organization or insight. A person learning to knit, for example, may struggle along for months making slow headway, then

master a new technique that accelerates progress sharply. Positive acceleration may also be seen in the early stages of some learning curves, for a person may learn practically nothing until he becomes adjusted to the task and the situation.

Long-continued learning curves often show a *plateau.* This is a period of no noticeable improvement, preceded and followed by improvement, as illustrated in Fig. 70. Such plateaus are usually due to a temporary loss of motivation, or to the diversion of effort to the learning of a new technique that will later produce positive acceleration. The curve of Fig. 70 could, in fact, be analyzed into two curves of the common, negatively accelerated type, the lower being the consequence of learning by a poor technique, which soon reaches its limit, the higher being the consequence of a superior technique.

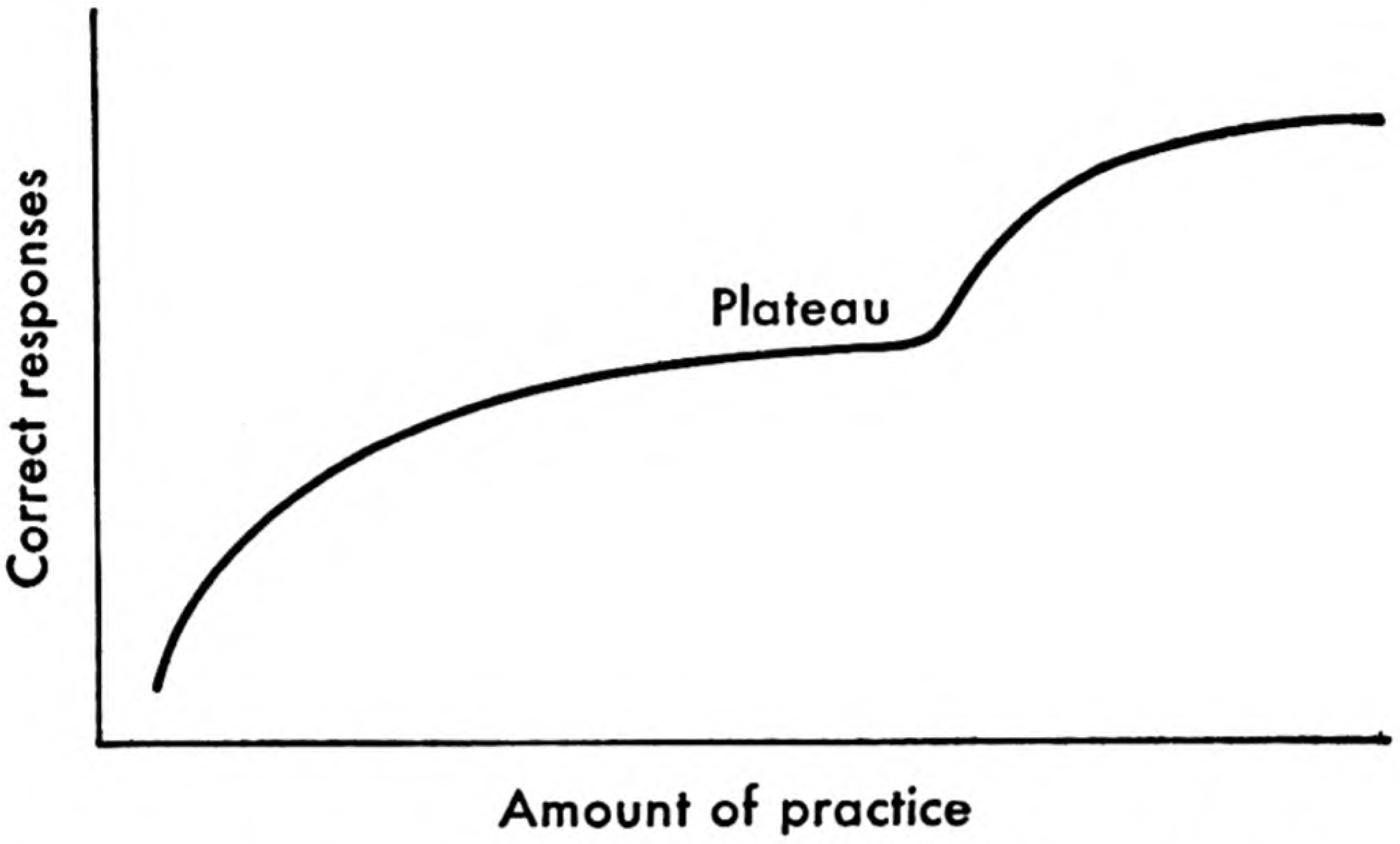


Fig. 70. This hypothetical curve is drawn to show that a learning curve with a plateau may be analyzed into two curves of the common negatively accelerated type. The lower curve could represent learning by a poor technique that soon reaches its limit, and the higher curve could represent learning by a better technique that has a higher limit.

Another thing that regularly happens as practice proceeds—and this is almost a definition of learning—is that the performance becomes mechanized or habitual; it requires less thought. The most dramatic evidence for this statement comes from watching school children do their homework. Prof. W. R. Brownell[8] of Duke University sat down with a large number of children working multiplication problems, like 6 × 3 and 5 × 7, to see just how they did them. In Grade 3A some of the children had learned their multiplication tables so thoroughly that about 40 per cent of the answers came automatically, with-

out deliberation. But others had to think about the problems, reversing 6 × 3 to make it look like 3 × 6, or working 5 × 3 and adding 3 more. And some just guessed. The children in the upper grades, who had had more practice, used less guesswork, needed less thought. As the graph shows their progress, in the upper half of the fifth grade 88 per cent of the answers came automatically, through sheer habit. (Not all of this improvement is due to practice, of course, for intellectual maturation between Grade 3A and Grade 5A is responsible for some of the change in method.)

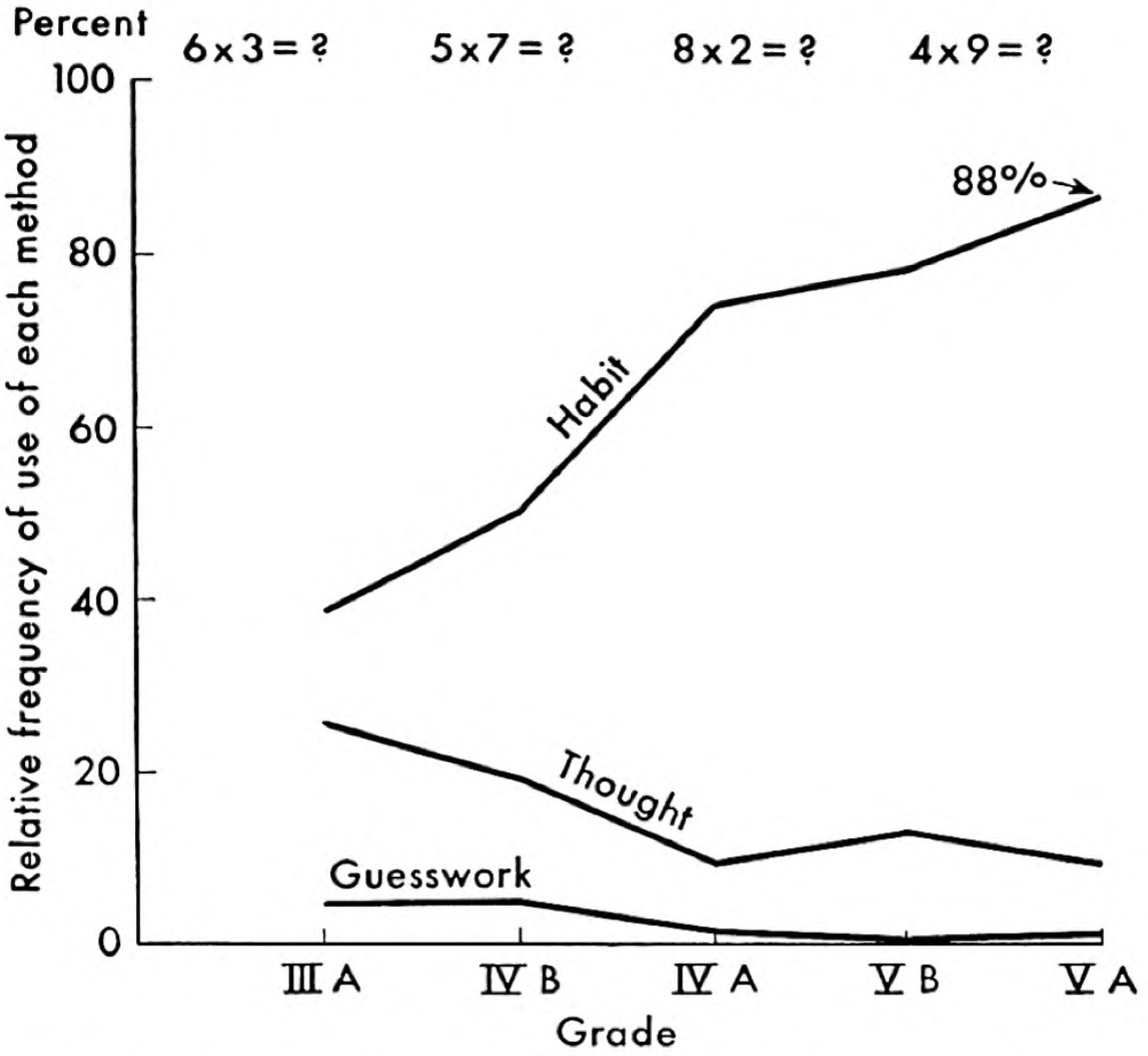


Fig. 71. Learning arithmetic. During the third, fourth, and fifth grades, as children practice their multiplication tables, the percentage of answers reached by guesswork declines, the amount of thinking necessary also declines, while the percentage of answers obtained mechanically, or by habit, increases. If a curve were drawn on this graph to represent average time required in each grade, how would it look? (*Data from Brownell.*[7])

## RETENTION AND FORGETTING

It is not enough just to acquire new patterns of response or emotion or knowledge; one must retain them. One must treasure these delicate traces, which practice has inscribed in the nervous system, until they

can be put to use. In fact, improvement in knowledge and skill is a race between practice and forgetting. If one were to practice typing every other week and rest during the alternate weeks, his progress would look something like Fig. 72. Names and telephone numbers are soon forgotten once they are no longer used, but the things we use often, like simple arithmetic, the English language, eating habits, social conventions, and ways of getting dressed, are seldom forgotten because they are constantly practiced and overlearned.

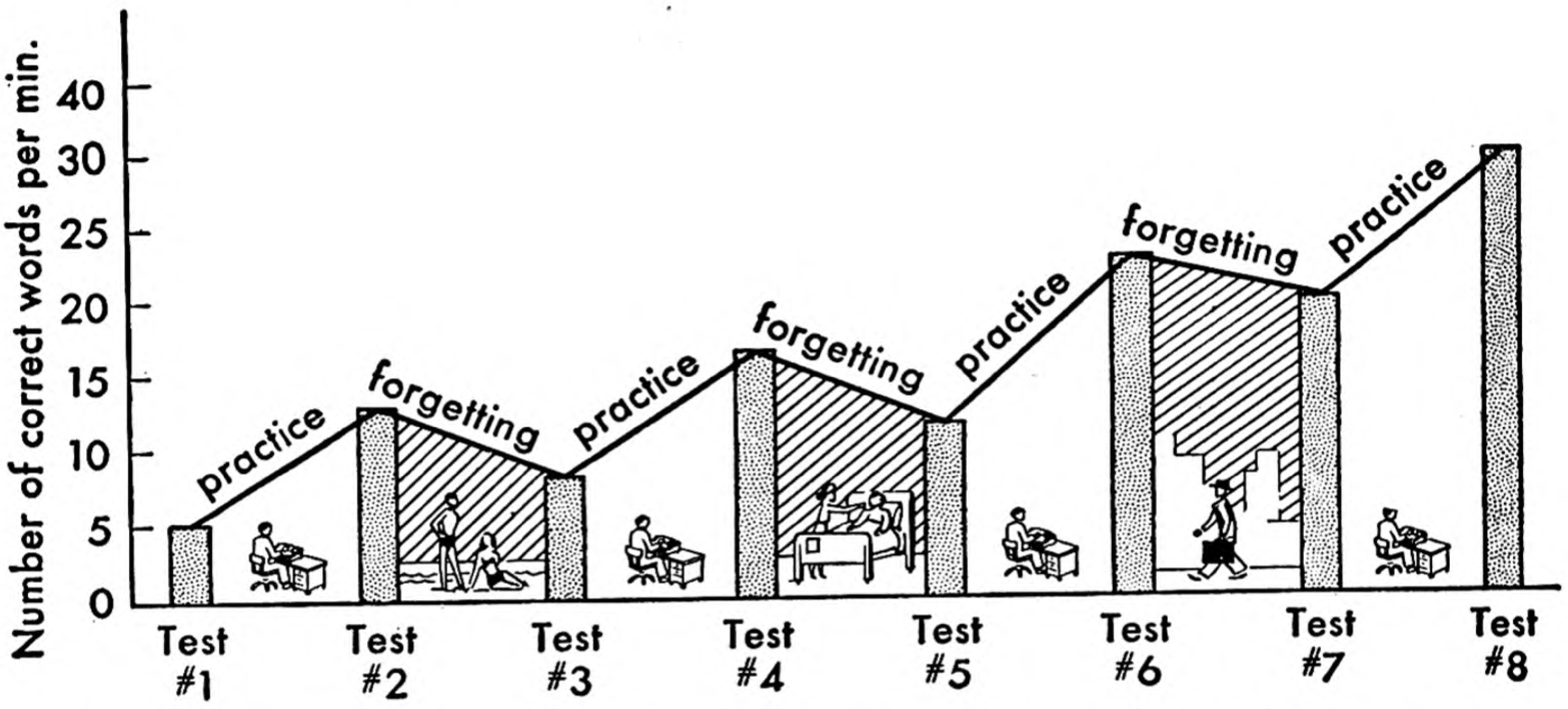


Fig. 72. Learning to type: a struggle between practice and forgetting.

Forgetting is studied in the laboratory by having a large group of subjects learn something, having them memorize a list of words, let us say, then breaking up the group and retesting some of them a few hours later, others a day later, others two days later, and so on, as long as time and patience hold out. Careful experiments of this sort, in which practice and review after the first test are specifically prohibited, indicate that forgetting is comparatively rapid right after practice ceases. In the first experiment on forgetting, the great German psychologist, Hermann Ebbinghaus, learned many lists of *nonsense syllables* (gur, dax, cil, lem, tof); then when he tested himself the next day, he found that he could only recall about a third of them. After the first day forgetting continues, but at a much slower rate.

Though nonsense syllables are forgotten rapidly (which is a sensible way to handle nonsense), other things are retained much better. When people read stories, they remember the essential points far longer than the nonessentials.[9] Concepts, generalizations, and principles are retained

quite well once they are mastered.[10] Retention curves for these meaningful kinds of material as well as for discrete, unorganized material are shown in Fig. 73.

The search for the *why* of forgetting has led to some curious goings on in psychological laboratories, and before long, psychological electricians will be carrying the search right into the brain itself. This much is already certain: *Most forgetting is due to the learning of something else.* Let us suppose that Sam Thomas comes into David Stone's jewelry store one fine December day during the Christmas rush and introduces himself. Then, along about the middle of February, Thomas stops in again. Will our friend remember his name? Probably not, because the memory for this name has been crowded out by the memory of other names. If Thomas made an impression on Stone, so that the latter took his name seriously and tried to remember it, then the name "Sam Thomas" must have left a trace somewhere in Stone's nervous system. If the story could end at this point, all would be well. But between December and February, Stone also met Lou Stiven, Tom

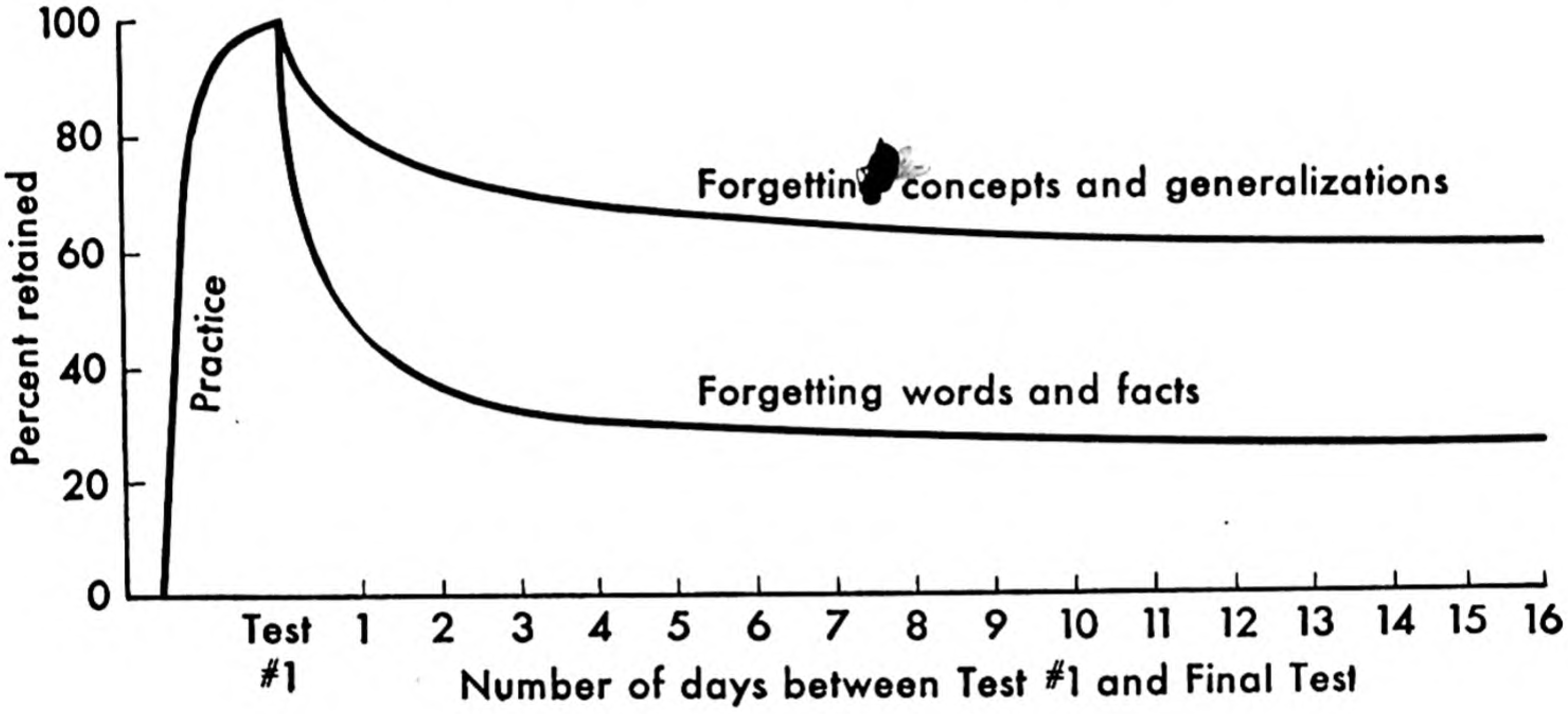


Fig. 73. Retention curves.

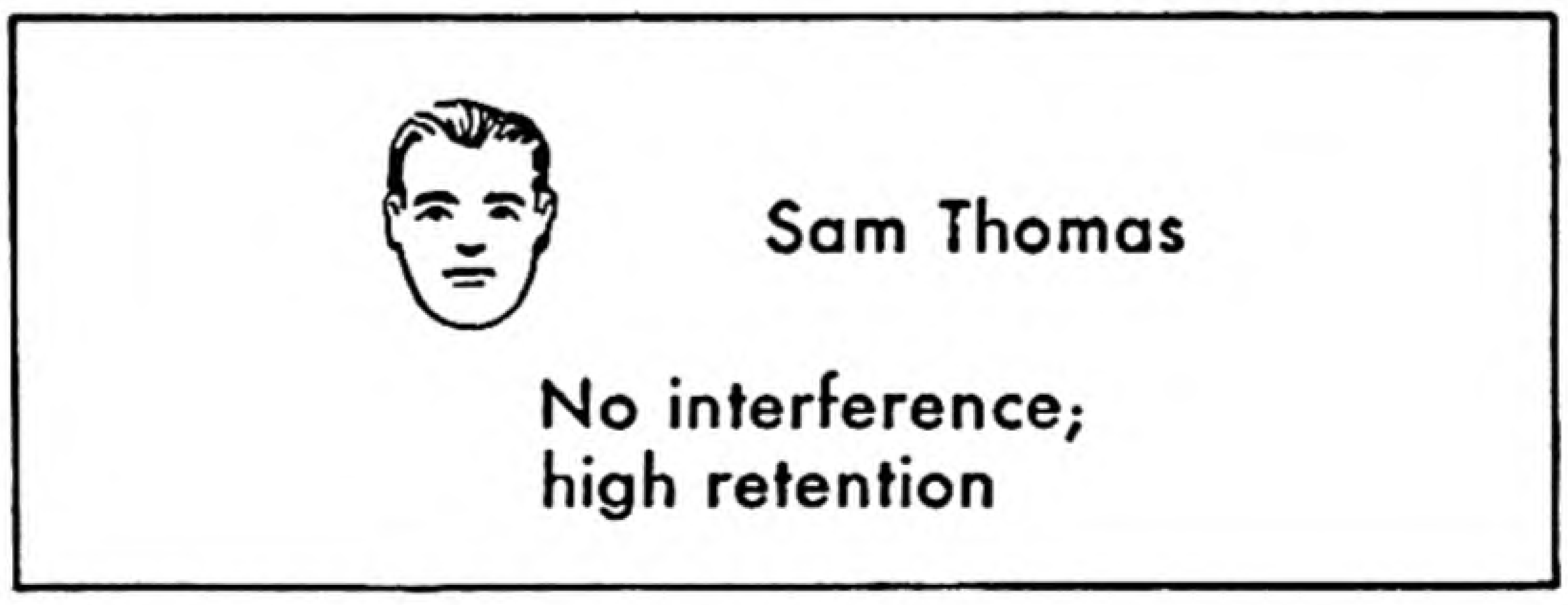


Fig. 74.

Samuelson, Sam Kurtz, Al Drabek, and Tom Swanson. And, unfortunately, the effect of "Sam Thomas" on Stone's nervous system is overlapped and confused by the effects of the other names. If Stone does call the man by name, he may call him Sam Thompson or Tom Sampson. This interference by other learning—*retroactive inhibition* is the technical term—is the principal reason for forgetting.

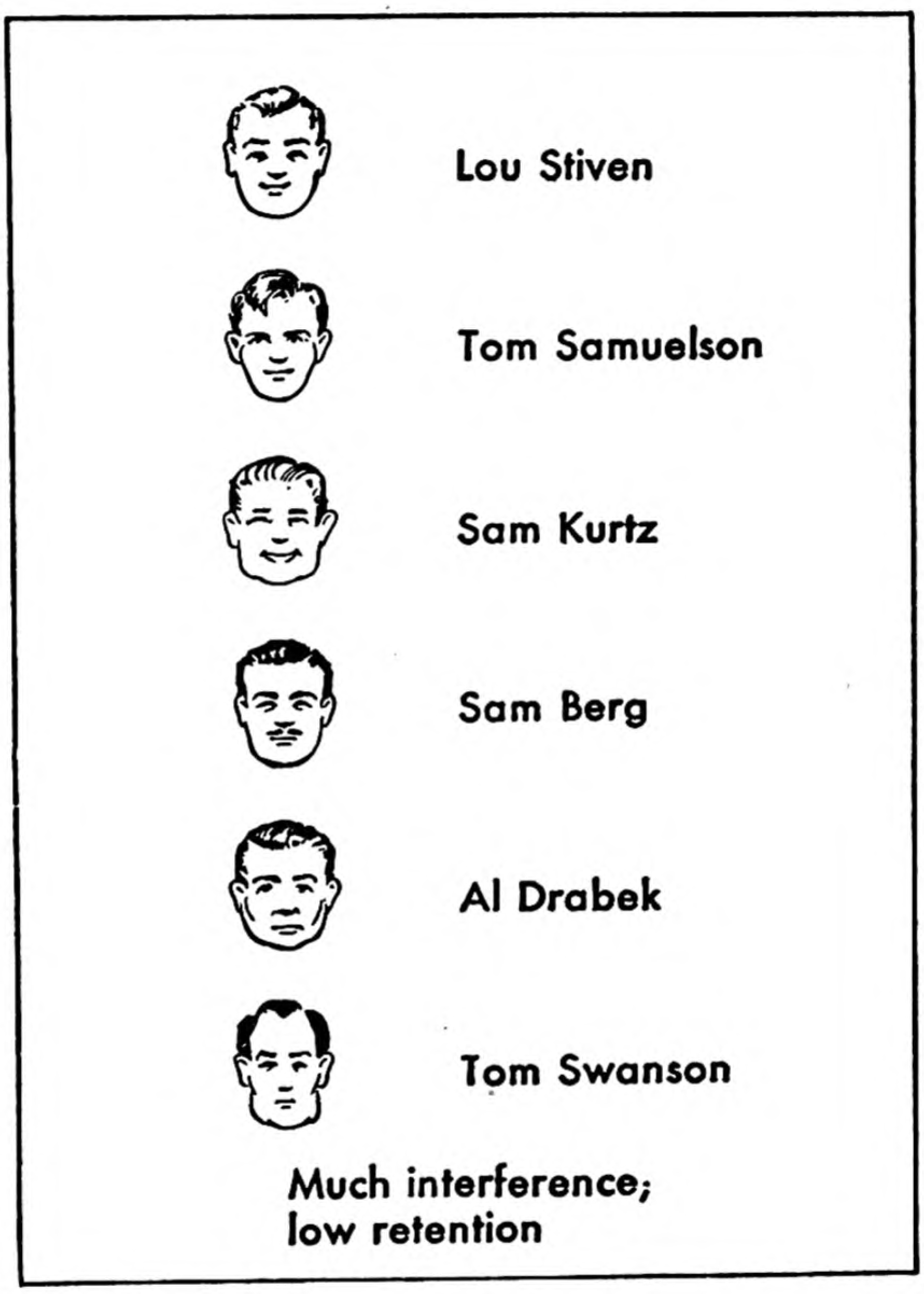


Fig. 75.

Contrast this poor retention of names with the good retention of skill at riding a bicycle. One learns through varied activity that when he starts falling to the left (What sense organs yield this information?), he is to turn to the left; when he starts falling to the right, he is to turn to the right. Nothing that he learns later will interfere very much with that coordination. So, even if one stays away from bicycles for 10 years, the coordination between falling and turning remains on tap, ready for use. If, however, other vehicles are developed, space ships perhaps, in which one turns to the left when he starts falling to the right, then,

and only then, will bicycling skill be forgotten as quickly as names and faces.

It follows from this effect of interference that the best way to remember something after practicing it would be to learn nothing else, that is, to lapse into a state of suspended animation. For those timid folks who are unwilling to go all the way, the next best condition would be sleep. After this the next best would be hypnosis, for one is usually quite inactive during the hypnotic trance. But, if one must be active and learning things, the least interference would come from learning things that are different from those that one is trying to remember. After Stone has memorized that 20-minute talk for the Alumni Club, he should sit down and rest awhile. At least he should avoid reading, talking, writing, and other traffic with words as much as possible. And this is one psychological principle that can be reversed. If Stone has a phrase or a tune running through his head, one of those singing commercials perhaps, and cannot get rid of the annoying thing, what is the best way to forget it? Obviously, to set another tune running through his head and drive the first one out. Getting rid of the second one will then be a little easier.

Although interference from other learning is no doubt the cause of most forgetting, it is not the only cause. The nerve cells that retain the effects of practice are living tissue and hence susceptible to several kinds of damage. In elderly people hardening of the arteries of the brain impedes circulation and often produces a spotty kind of memory loss, particularly for recent events. Accidents serious enough to produce unconsciousness may cause loss of memory. If a person has an accident involving a blow on the head at 11:30, he may, when he comes to, have no memory for events immediately after 11:30, to be sure, but also, in some cases, for events just previous to 11:30, between 11:25 and 11:30. This is forgetting of a sort, probably caused by disturbance of the memory traces before they have become consolidated. Recently psychologists have discovered that an electric current passed through the brain may destroy memory quite completely, though temporarily. Sharp, Winder, and Stone,[11] at Stanford University, for example, trained rats to work a difficult problem, then gave them shocks strong enough to produce convulsions and tried them on the problem again. An hour and a half after the shock the rats could do nothing

right, but 22 hours later, they were almost as good as new. There is no doubt that direct electrical, chemical, or mechanical disturbance of the brain tissue will produce more or less memory loss, but fortunately, the loss is often only temporary, and furthermore, the brain is so well protected in its bony cranium that such disturbances are rare.

## REPRODUCTION AND RECALL—HOW CONDUCT IS MODIFIED BY LEARNING

Let us return to Mr. Stone, and Mrs. De Giacomo, and Miss Eisner. They and their fellow citizens, motivated by hunger, fear, sympathy, esthetic tastes, or what not, learn and forget enough to fill and empty many books. It is impossible to understand these three characters in our drama, or any others, without understanding the psychology of learning. But for a genuine understanding of the psychology of learning, we must always come back to the actual activities of these good people as they go through their accustomed routines, on and off stage. When and how will the knowledge, skills, prejudices, ideals, and emotions that Mr. Stone's past experiences have deposited in his nervous system come to the surface and affect his daily round of work and play in the future? Why does Miss Eisner's memory serve her well in some situations and embarrass her in others?

As we have seen, the learning process can be analyzed into three phases, the first being the acquisition of new response patterns, the second being the retention of these, or traces of them, and the third being the activity, on a later occasion, which is modified in some way by the previous activity. The activities of the learner on this final test are crucial, for if he does not reproduce what he is supposed to have acquired, or demonstrate in some way that his behavior has been modified by his activities, no one can be sure that he has learned anything.

It is relatively easy to prove that behavior on the final test has been modified by previous practice, if the learner is actively trying to demonstrate the skill he has practiced. One method is to get the learner to reproduce what he has learned, *i.e.*, to repeat a poem he has memorized, to play a musical selection, or to juggle three billiard balls, if that is what he has been practicing. In general, what a person has acquired, and retained, can be tested by asking him to reproduce or reperform it. His performance may be scored in terms of errors, time, or suc-

cesses, and these scores can then be compared with similar scores before practice to determine how much lasting effect the practice has produced.

If the material learned is poetry or information, reproduction of what has been learned is termed *recall.* Most of the examinations used in college ask for recall of previously learned material. "When was the Battle of the Bulge?" "What are lepidoptera?" An easier question is one of *recognition.* Which of the faces in Fig. 76 appeared in an earlier figure? Another method, a delicate method that uncovers slight traces of learning too weak to produce recall, is the *relearning method.* Let us say that a student in English 14 memorized a certain poem in 40 minutes and repeated it correctly in class. One year later he is asked about the poem but cannot recall a single word. Forgetting appears to be complete; retention is zero. But let us ask this student to memorize the poem again, to relearn it. He will probably not require 40 minutes but definitely less. If he needs only 30 minutes to do what he previously did in 40 minutes, other conditions being constant, he must have remembered enough to save him 10 minutes in learning time. The method is also called the *savings method,* and the saving is often put in terms of a percentage, which in our example would be 25 per cent.

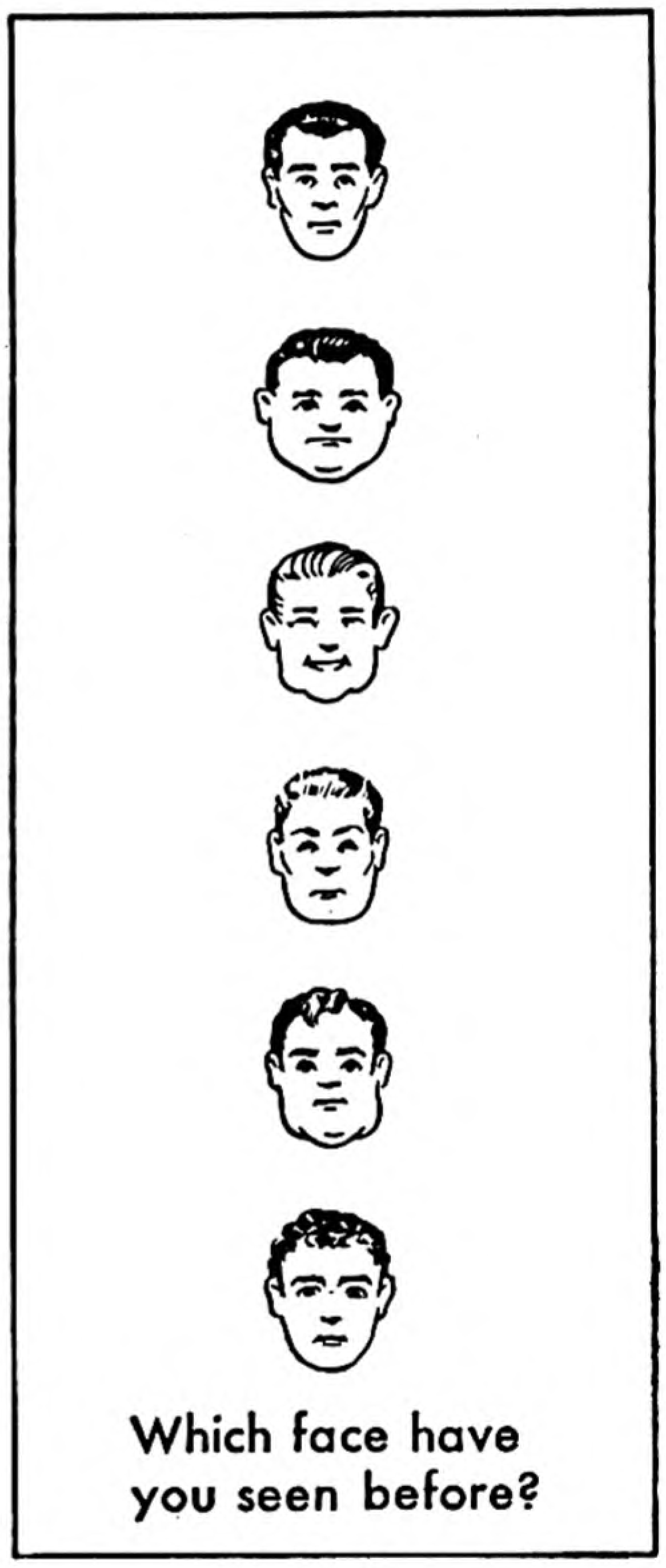


Fig. 76.

One can satisfy himself, though perhaps no one else, about what he remembers, by calling up a *memory image.* Close your eyes and try to recall the face of Sam Thomas, or the voice of your favorite singer. Such a test of what one has retained is a subjective test, of course, and as such is not convincing to other people. But it is likely that memory images are useful during the process of giving objective evidence of retention, as by verbal description or by drawing.

There are other changes in behavior as a result of previous experience besides improvement in knowledge and skill. Careful observations

and comparisons of behavior on two or more occasions will often demonstrate that several social aspects of conduct have been changed in some way. Motives, emotions, attitudes, interests, and habits of social interaction are acquired and modified by practice or training. Testing for the effects of learning on these aspects of behavior is more difficult than testing for changes in knowledge and skill, because it is harder to control some of the extraneous variables. To prove, for example, that a boy has learned, during a month in scout camp, to be more self-reliant than he previously was requires that behavior before and after training be accurately compared, that factors like maturation and physical health be ruled out, and that all important conditions of the final observations be similar to those of the observations made before camp. In spite of these problems, psychological experiments on the learning of these more subtle aspects of behavior have been carried out, and the evidence will be discussed in the latter half of this book.

All the facts and principles of learning discussed in this chapter come from one or more of these methods of testing what has been learned. The evidence on the acquisition of new responses was obtained by keeping the conditions of retention and reproduction constant. The evidence on retention was obtained by keeping the conditions of acquisition and reproduction constant. We now turn to the evidence on reproduction, which has been obtained by holding the conditions of acquisition and retention constant and varying the conditions of the final test. What conditions promote recall or reuse of a large share of what has been acquired and retained? What interferes with recall and recognition?

To begin with, the motivation at the time of the final test has a strong influence on the remembering of what has been learned, just as it has on the original learning. When Stone is trying to type a letter, he is wholeheartedly using all the skill he has retained from his practice. But when he says he is trying to recall a name, that wholeheartedness may be lacking. If his experience with Sam Thomas was unpleasant, he may not recall anything about the old so-and-so. When his young son asks him how he liked school when he was a boy, will Stone really try to remember everything? This *repression*, or inhibition of memory for a purpose, operates unconsciously but often effectively, barring recall of the nastier memories and perhaps, as in the case of some am-

nesia victims, barring recall of one's own identity and family connections. Proof that these things are defects of recall rather than of retention is obtained when certain special techniques of the psychiatrist or psychologist, such as hypnosis, free association, and drugs, or merely a sudden accession of confidence in the listener, cause the troubled victim to tell all.

There is a little game that psychologists used to play many years ago; practicing lawyers also have long been familiar with the principle behind it. One would assemble a crowd of people on one pretense or another, then stage an exciting incident in front of them. A stranger would come in and words would be exchanged. Voices were raised. Blows were struck and furniture broken. Then the stranger would run off, the psychologist would smooth out his beard, and, explaining to the spectators that this unfortunate affair might have legal consequences, would ask them please to write down exactly what had happened in the past 5 minutes. Since the act had been carefully rehearsed and the true sequence of events was known, a comparison of the testimony of the spectators with the objective record was always highly enlightening. As one might expect, the witnesses, being excited and unprepared, with their own personal interests and preoccupations, missed a large part of the scenario. But most witnesses will somehow tell a coherent story, filling in the blanks in their memories with whatever is necessary to round out the tale.

These experiments, and others like them, have led psychologists to emphasize the importance of motivation in recall. When a learned act is repeated or a once-heard story is recalled, the second performance is not, as one might suppose, a diluted reproduction of the first. Under certain artificial conditions, one may deliberately and conscientiously try to do exactly what he did before, or to tell the story exactly as he heard it. But more often a person has other motives. He may not be trying to fly the airplane just as he was taught; he may be using the skill he has retained for the purpose of getting a thrill, or shocking his friends. If he is trying to entertain, he uses his memories as he sees fit, editing, embellishing, emphasizing, and censoring to suit his audience and his purpose. If he is overawed by a shrewd lawyer, he may recall things in court that he had not heard of previously, or repress what seems inappropriate. Psychologists summarize these facts by saying that

recall is a constructive, not merely a reconstructive, process. One uses what he remembers as an instrument for furthering his activities of the moment.

After motivation comes the situation, as a factor in the use on a later occasion of what has been learned earlier. The principle is a simple one: One is likely to do in the second situation what he practiced in the first, if the second situation is similar to the first. (This principle is merely a special case of the general scientific principle that behavior is the end result of many contributing factors, or independent variables; the more similar the set of independent variables, the more similar will be the end result, or dependent variables.) Everyone knows how easy it is to recall a person's name when his face appears in a familiar situation, and how hard it may be when the same face is seen in another city. If Miss Eisner sees RSVP at the end of an invitation, she recalls its meaning immediately, but when she is asked on a quiz program the meaning of RAF, AVC, and RSVP, those four letters may sound altogether foreign to her. In respect to habits of conduct and moral standards, the effects of practice are likewise compartmentalized. In a business situation business practices are recalled; in a friendly game of tennis, what comes to mind is another set of rules and standards of conduct.

When we say that similarity between the situation at the time of remembering and the situation during practice is an important factor in the adequacy of the remembering, the similarity must be understood as a psychological similarity, not necessarily a physical similarity. Two examples will make this distinction clear.

In the past few years automobile shift levers have been moved from the floor up under the steering wheel. When shifting from first into second in the older cars, one pushed the lever forward and to the right. In the newer cars, one now grasps the shift lever in an altogether different grip and pushes upward and forward. Geometrically the new situation is quite different from the old, but psychologically, taking the individual as a reference point, the two are very similar and, as a matter of fact, everyone makes the transfer easily.

For our second example, consider the case of a little girl when she goes to school the first day and makes the acquaintance of her teacher. Will the habits she has learned at home carry over to the new situation?

Will she react to the teacher as she has learned to react to her mother? In principle, the answer is simple: She will transfer a large share of her already formed habits of conduct to the new situation if she perceives the new situation as similar to the old; otherwise she will learn a new set of social habits, which may be quite different from the old.

The technical term for the utilization of old learning in new situations is *transfer of training*. Though nearly all remembering involves transfer to some extent, since two situations are seldom exactly alike, the question of how much transfer will occur under different conditions has special significance for educational psychology. It is an important practical question whether, if one wants to learn physics, studying algebra first will be of any help. Which of these would be the most valuable as a prerequisite to a course in biology: history, geometry, chemistry, or tap dancing? Most students will answer chemistry, because chemistry and biology overlap in content more than the others. And that gives us a clue to the principle behind transfer of training: Training in one branch of knowledge or skill will transfer to another just to the extent that the two have something in common. They may have a *common content*, as in the case of algebra and physics, or economics and sociology, so that what one learns in one course can be applied directly in the other. More often what the two have in common is not obvious, but must be studied out by the student or pointed out by the teacher. Many school subjects have this in common, that study *habits* and *techniques* developed in one may be carried over to the other. If a student studying hygiene works out some useful tricks of resisting distraction, or of forcing himself to continue when bored, or an efficient way of taking notes, he may be able to use these same tricks when he studies Latin or English history. If a salesman learns some techniques of meeting people that are effective in selling, he may find, when he becomes a buyer, that the same techniques are effective in his new job. Or, if one has learned that he can defend his ego by rationalization, he may carry that technique over to all situations that appear threatening. In general, one may transfer facts, principles, techniques, attitudes, and all kinds of habits from one situation to another, but the likelihood of transfer is greater when the new situation is perceived as being similar to those situations in which these things were originally acquired.

## SIX KINDS OF THINGS THAT PEOPLE LEARN AND HOW THEY LEARN THEM

From the cradle to the grave people are continually learning something. A large share of the activities of David L. Stone on his fiftieth birthday and a large share of his personality are the results of this ubiquitous learning process. For the sake of convenience in studying, we can group the many things that Mr. Stone, and everyone else, learns during one lifetime into six large classes. We shall examine these six classes of things that people learn, one at a time, and see how the principles of learning, as laid down in this chapter, help us to understand the development of complex human beings in a complex world. (These six kinds of things that are learned should not be confused with the four processes or ways by which they are learned.)

**1. *Motor skills.*** Much of a person's development is due to the learning of movements or motor skills, *i.e.*, learning to manipulate a knife and a fork, to dance, to write, to handle tools and operate machinery, to plow a straight furrow, to pluck eyebrows, to play musical instruments and games of skill. More precisely, these should be called sensorimotor skills because the things that are learned are not merely responses but responses *to* sensory stimuli, coordinations between what is perceived and what is done.

Some of the simplest coordinations are learned by conditioning, and perhaps some complex coordinations also, for conditioned responses may be chained together in a series. Most motor learning is a matter of varied activity, however. The child holds his knife one way the first time, a little differently the next time, still differently the next, and so on. The grasp that is more often reinforced by success will be practiced and retained. Irrelevant, accessory movements are likely to be eliminated in time. Social interaction also enters into the learning of many motor skills, for the learner may be instructed by others or may imitate them. Even when guidance is available, however, everyone must go through a certain amount of trial and error for himself.

As motor learning progresses, speed and accuracy usually increase, if the motivation is good and practice is regular. Amount of effort required usually decreases. When the skill to be learned is a complicated one, as in the case of typing the word "ever," a simple coordi-

nation, like seeing *e* and hitting the *e* key, soon becomes telescoped, as practice proceeds, into the next stimulus-response unit, seeing *v* and hitting the *v* key. The process starts out like this:

See *e* → Hit *e*
See *v* → Hit *v*
See *e* → Hit *e*
See *r* → Hit *r*

But these eye-hand coordinations soon *overlap* like this:

See *e* → Hit *e*
See *v* → Hit *v*
See *e* → Hit *e*
See *r* → Hit *r*

And still later the word is seen as one pattern of four letters, and the four keys are hit in a smooth well-integrated pattern of movements.

See "ever" → Hit "ever"

The learning of any complicated pattern of movements, like flying an airplane, playing a one-man band, and talking, necessarily involves the mastery of such *higher units* or habits. Learning is not complete until these higher units are organized into a system of acts, a habit that can be started or stopped, speeded up or slowed down, as a whole, as a flexible integrated machine at the service of any drive. In reading aloud, for example, the delivery must be geared to the perception of the words, but, if the reader is well practiced, it is a fluid or hydramatic sort of gearing in which the voice may follow close behind the eye or a long way back. This eye-voice span can easily be demonstrated as a parlor trick any dull evening, if some eager performer can be induced to read aloud for a few minutes. After he gets well into his stride, quickly shove a magazine in front of him, shielding the book, and count the words he reads when he can no longer see the page. If he is a good reader, he will continue for five or ten words after his vision is cut off.

*A note on maturation and physiological limits.* Not all improvement in motor skills is due to learning, for some accomplishments, like walking, appear at a certain age with relatively small amounts of practice. Their

development depends more on maturation than on practice. Maturation was discussed briefly at the beginning of this chapter, but now that we understand about the effect of an upper limit to improvement on the rate of improvement (see page 157), the relation between maturation and the learning of motor skills can be more clearly explained. The effect of maturation is to raise the physiological limit (see page 136) so that a given amount of practice produces a greater amount of improvement. Figure 77*A* represents the case of an immature organism in which the physiological limit for some particular skill is at zero. Practice will, of course, produce no improvement at all. *B* represents the case of an organism at the critical age when maturation has raised the physiological limit slightly. Assuming that a given amount of practice raises the level of performance a constant fraction of the distance to the upper limit (see Fig. 67), relatively large amounts of practice will be necessary for a small improvement, and the learning curve will be a short flat one. *C* of Fig. 77 illustrates a tall thin learning curve, which is obtained when maturation has raised the physiological limit greatly, so the same amount of practice will produce a large improvement.

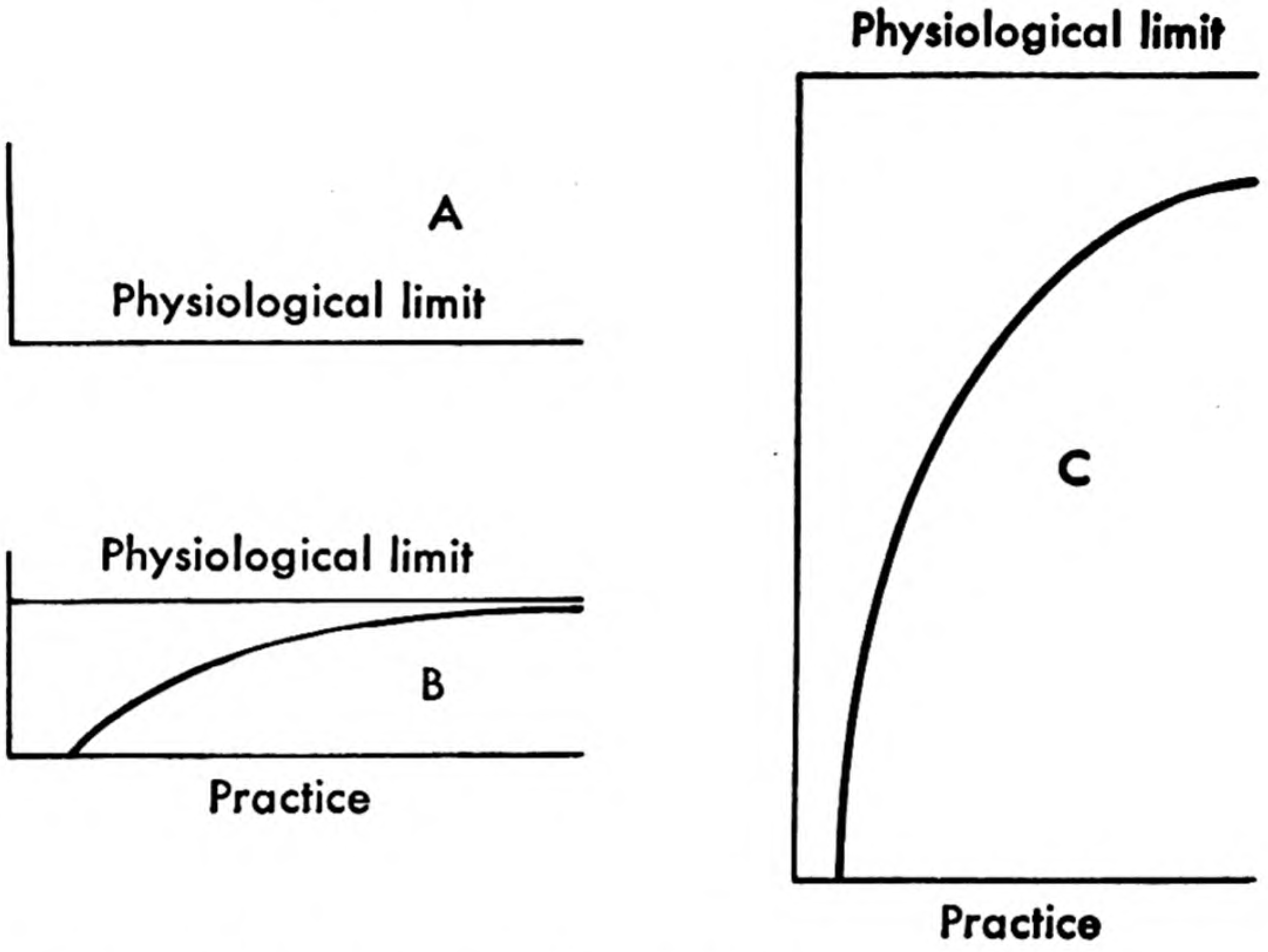
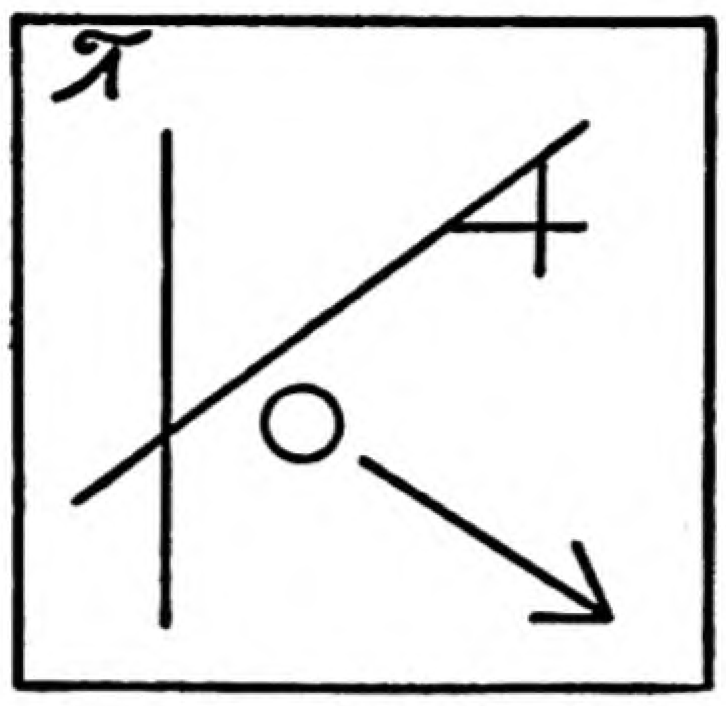


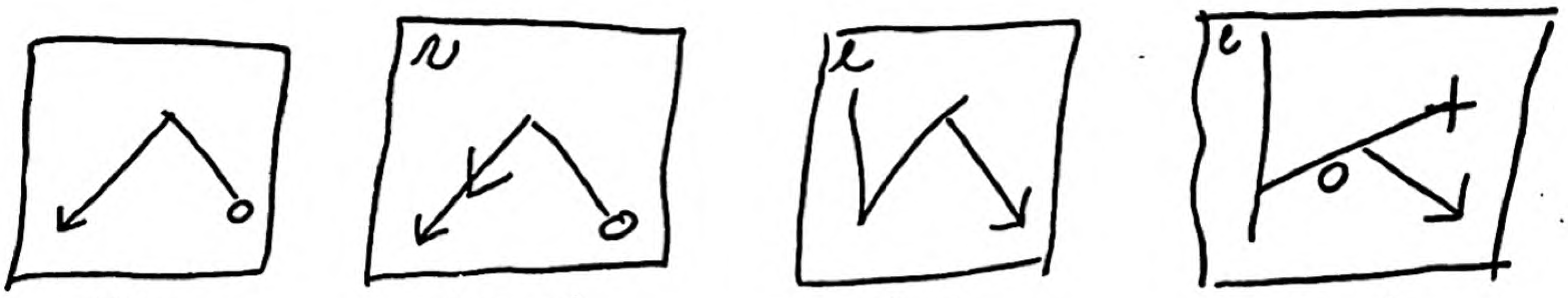
Fig. 77. Curves drawn to illustrate the relation between maturation and physiological limits. *A* represents the case of an immature organism in which the physiological limit for some activity is at zero. No amount of practice will produce any improvement. *B* represents the case of an organism at an intermediate stage of development, when maturation has raised the physiological limit slightly. A large amount of practice will produce a small improvement in skill. *C* represents a mature organism in which the limit is high and a relatively small amount of practice will produce a high level of performance.

**2. Modifications of perception.** A good share of what we learn, probably more than most people realize, is *perceptual learning*, learning the location and significance of things, acquiring perceptual habits and attitudes, reorganizing what is perceived into new patterns. Usually perceptual patterns are learned very quickly, but for experimental purposes the process can be broken down and studied in slow motion. The subject of the experiment is allowed to look at a design, such as the model in Fig. 78, for just a moment, then is asked to draw it. Then he is allowed to see it again briefly, and again he tries to draw it. Doing this repeatedly, until learning is complete, yields a record, like the one in Fig. 78, of progressive improvement. Forgetting of the design is studied in the same way, by asking the subject to draw what he remembers at different intervals after his last view of the design, though one must remember that each attempt at reproduction affords an opportunity for practice. In learning designs like these, the general outline is grasped quickly and forgotten slowly, as the figure shows. Details are usually learned with more difficulty, but an outstanding detail, like the *T* in the figure, may be learned quickly and retained well.

For other examples of the modification of perception by learning, one may consider listening to the complex sounds of a 100-piece orchestra and gradually learning to pick out the contribution of the separate instruments, or learning to use a microscope or to assemble a jigsaw puzzle, or learning the location, in a large library, of books with the call number 150.5. One also learns the significance or meaning of what is perceived, of an arrow, for example, or a doorbell, acquiring in the process a knowledge of its relation to other parts of the perceived situation and its utility for one's own activities. One of the important lessons learned in the Second World War is that all instruments, such as dials, range finders, gun-sighting systems, radar screens, and telephone communication arrangements, must be designed to fit the human beings who are going to use them, so that perception time and learning time will be cut to a minimum. Engineers and psychologists are now working together in government-financed research teams to design psychologically sound instrument panels for those supersonic planes that will fly half a mile while the pilot is reading one dial, and to adapt radar so that the blind can hear the outlines of obstacles in front of them.



Model

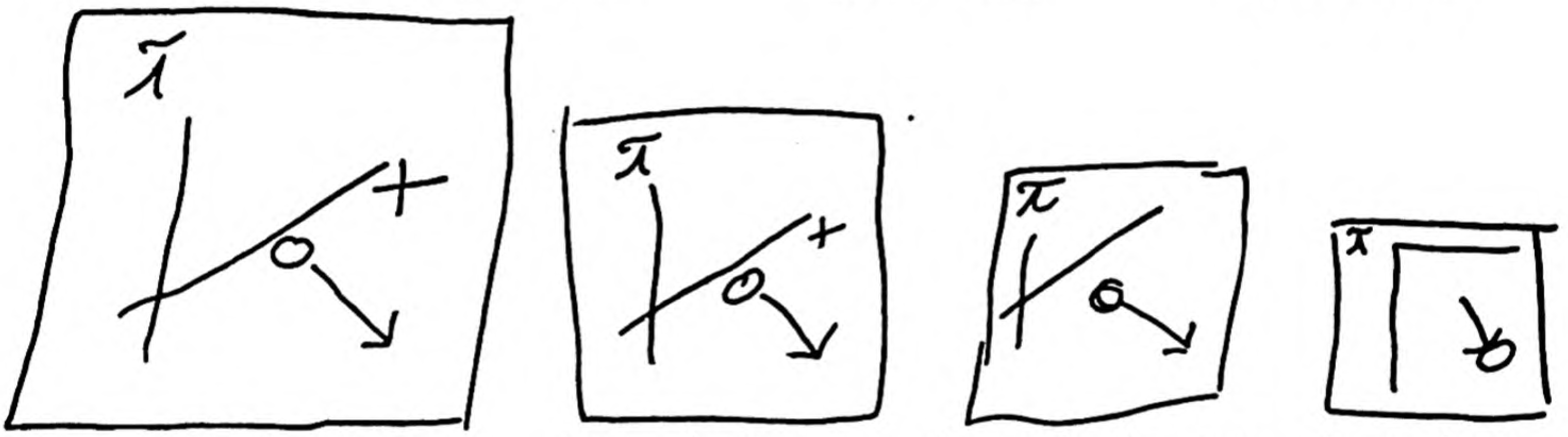


First reproduction

Second reproduction

Third reproduction

Fourth reproduction

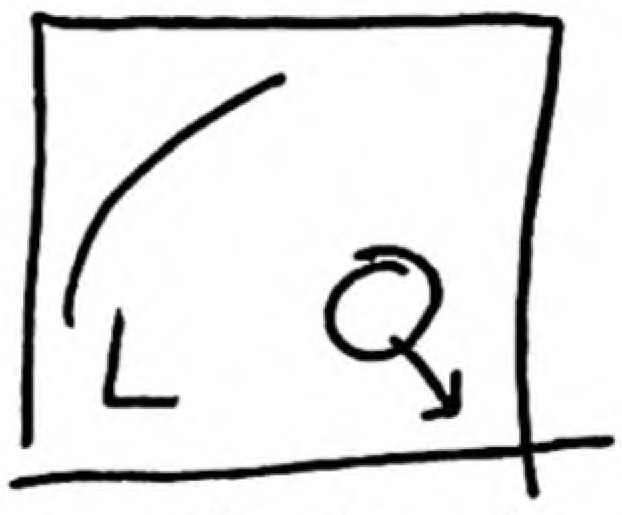


Tenth reproduction

Reproduction one day later

Reproduction two weeks later

Reproduction six weeks later



Reproduction six months later.

Fig. 78. Learning a design and forgetting it. The model was shown to the subject for 10 seconds, then she was asked to draw it. One day later she was given another look for 10 seconds, and she drew the second reproduction. And so on, once a day. After 10 trials the design was reasonably well learned.

To check on the course of forgetting she was asked 1 day later, on the eleventh day, to draw the design from memory. Retention for 1 day was quite good, and even for 2 weeks. Later reproductions retain only the general outline and some fragments.

How does perceptual learning take place? And how does the learning of perceptual patterns differ from the learning of motor skills? Perceptual learning is chiefly a matter of learning by organization, putting the parts together into a new pattern, or breaking up a pattern into other more useful configurations. Trial and error comes into operation when the perceptual field can be organized into several patterns, that is, when an object looks different from different angles, or when something is heard but not seen. An object in dim light may be seen first as a bush, then as a man, then as a scarecrow. When one interpretation of the matter is finally accepted, the others may be called *illusions.* Some perceptual learning requires social interaction, for often one does not know what to look for or listen to until a teacher points it out to him. A large part of learning to cook is learning how the food looks, or smells, or feels, at the best moment for removing it from the fire; and if one learns from an expert what to look for, several hours of trial and error and a few burnt steaks may be saved.

### 3. *Isolated words and facts.*

1. When did Hannibal cross the Alps?
2. What is the atomic weight of sodium?
3. Who wrote *Pigs Is Pigs?*
4. What is the value of pi to four decimal places?
5. What is the postage rate for first-class mail?
6. What is the French word for "thought"?
7. Who won the Rose Bowl game in 1947?
8. Recite the three lines that follow this one:

> "My father, he was a mountaineer."

These eight examples illustrate another large class of material that has to be learned. Adults are different from children partly because they have been around more and have picked up more odds and ends of information, more telephone numbers and names. Such information is often called verbal information, or *verbal learning,* to indicate that one may merely repeat the words without understanding their significance. When the process is a deliberate one of intentionally committing words and facts to memory, the terms *rote learning* and *memorizing* are often used.

Such learning is, by definition, not learning by organization; the emphasis is rather on activity or practice. One reads or hears some-

thing and repeats it, with errors perhaps, and continues to repeat it, checking his errors as he goes along, or being checked by other people. The role of social interaction with other people is particularly important in the learning of names for people and objects, for the "punishment" of being misunderstood is usually immediate and clear-cut.

**4. *Concepts, generalizations, principles.*** A person has acquired a *concept* when he treats many different objects, ideas, or events as members of the same class and makes approximately the same reaction to all of them. Perceiving the objects shown in Fig. 79, for example, he may note, by looking, feeling, hefting, tasting, and other kinds of exploration, that some of them are approximately the same in size, shape, taste, density, and so forth. He is likely to put these together in one class of objects, excluding the others which are noticeably different. This process of picking out the common characteristics of a class of objects is greatly facilitated when a word, such as "apple," is heard in connection with each member of the class and is not heard in connection with the others. The meaning of the word "apple"—and this is the difference between verbal learning and the learning of concepts—is the common characteristics of a class of objects with the peculiarities of particular objects eliminated from the concept. Once this meaning is grasped, when one hears the word "apple," he is likely to think of these common characteristics of apples. This is how concepts of "apple," "chair," "man," "pencil," "night," "dog," and other familiar ob-

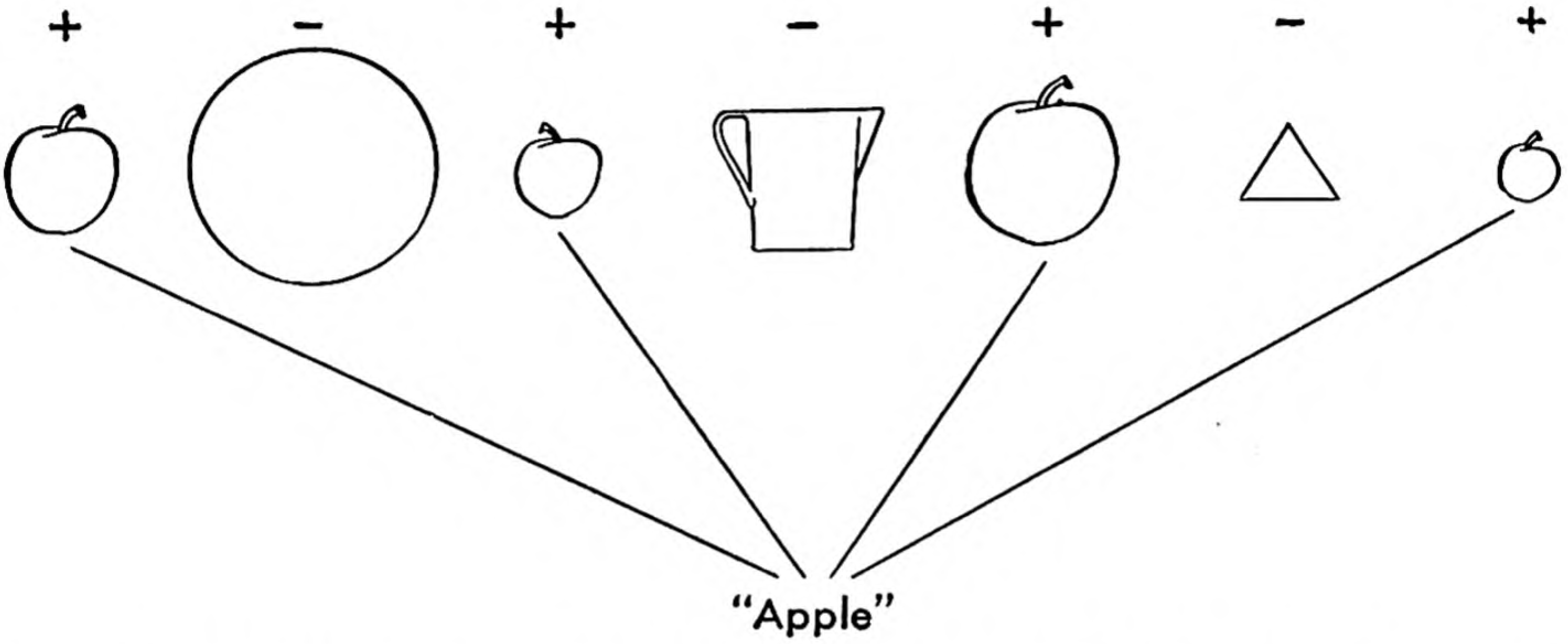


Fig. 79. Concept formation. The child hears the word "apple" when he sees some objects, but not others. And he is rewarded if he says "apple" when he sees some objects, but not others. Thus he generalizes the concept of apple and differentiates it from other concepts.

jects are learned, from direct experience, with the aid of language. In logic this procedure of working from the specific to the general is called *induction.*

This learning of concepts is a special case of learning by organization. The learner combines or organizes the effects of stimulation by the different objects. Because it is the common or general characteristics of the objects which are organized to form the concept, the term *generalization* is also used for this way of learning. *Differentiation* refers to the other side of the process, the elimination from the concept of "apple" of balls, oranges, and balloons.

Although the learning of concepts is principally a matter of organization, the other types of learning may be involved also, for generalization and differentiation occur in all types. We have seen earlier (page 154) that generalization and differentiation occur during the conditioning process, and it is probable that conditioning contributes to the development of those simple concepts that are learned by direct perception. The trial-and-error type of learning may operate also, because the first concept learned is not always rewarded. Generalization is perhaps a primitive property of the nervous system, but differentiation requires continued varied activity, with differential reward and punishment. Social interaction also enters into the learning of concepts whenever the concepts are used in communication. People teach the concepts to other people, and the process of communication rewards the use of concepts that are in standard usage. The requirements of daily discourse guarantee that motivation and practice will be sufficient for the mastery of the most common concepts of ordinary speech.

*The shape of the curve for learning concepts.* Knowing that concepts are learned primarily by organization, and knowing that learning by organization often yields a curve of positive acceleration, one would predict that the curve for learning concepts might, under favorable conditions, show positive acceleration. As a matter of experimental fact, such curves have been obtained in the psychological laboratory. Figure 80 shows curves for three people learning concepts, two of which are almost straight lines, while the other is positively accelerated. None of these looks like the typical negatively accelerated curves for motor learning and memorizing nonsense syllables.

This difference in the shape of the learning curve is one objective

difference between the learning of concepts and the learning of isolated words and facts. The difference in shape of the retention curves (see Fig. 73) is another. Still another difference is one of economy. To memorize 60 words in one sitting requires far more than twice as much time as is required to memorize 30 words, but to organize 60 words into a system of concepts requires far less than twice as much time as 30 words.[12]

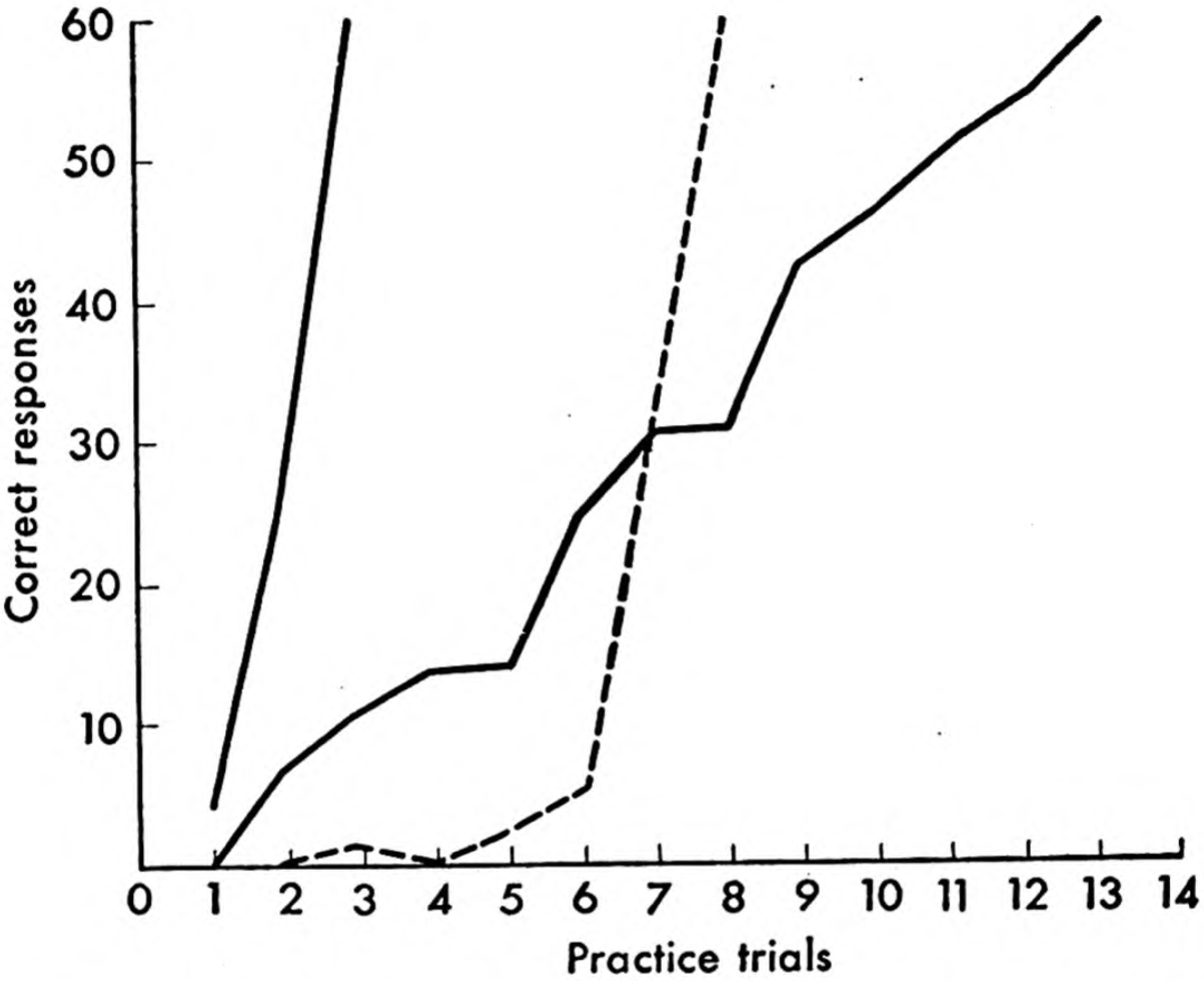


Fig. 80. Learning curves for the mastery of concepts. Each curve represents the progress of one subject. Which of the standard curves in Figs. 65-69 do these resemble most? Is there any evidence of a plateau? (*From H. B. Reed.*[12])

From the standpoint of social utility, concepts are exceedingly handy because it is easy to write or say "apple" when referring to a large class of objects, but it would be very awkward to be compelled to refer to Object No. 1 of a specific size, shape, taste, and density, Object No. 2 of a specific size, shape, taste, and density, Object No. 3 of a specific size, shape, taste, and density, and so on. Their laborsaving value is tremendous. Difficulty arises in the case of more *abstract concepts,* like "excellent," "sin," and "free enterprise," which no one can point to, and there is consequently much less uniformity in their usage. What uniformity there is in the usage of words can be measured, however, as we shall see on page 255.

It is possible that some other animals form and use concepts of a

simple order, but to man, with his large complex brain, the formation of concepts is only the beginning step of an extraordinarily complicated adventure in conceptualization. The study of nearly all serious college courses, for example, consists largely of the mastery of simple concepts, followed by the organization of these into larger systems of concepts, and generalizations or principles about facts and concepts. In psychology, for example, which is a highly abstract field of study, one begins by learning the meaning of such elementary concepts as maturation, learning, and physiological limit, then, when these are mastered separately, one is ready for a higher, more difficult level of abstraction, as illustrated on page 174, in which all three concepts are tied together in a comprehensive generalization.

Like concepts, generalizations are founded on the observation of particular events, especially the relationship between events. If one observes that certain events are usually followed by other events, as practice is usually followed by improvement, he has made a generalization. Some generalizations hold up under further observation and check (or trial and error); some are proved false. If a tentative generalization is refined and proved to be true under a wide variety of conditions, it may then be called a *principle* or perhaps, if it can be stated precisely, a *law*. The onward march of civilization depends on the development of new concepts and generalizations by a few brilliant leaders of thought, and the subsequent mastery of these by thousands of followers.

It is this ability of man to generalize, his delight in busying himself with abstractions, which, as much as any other function described in this book, has endowed man with his particularly human qualities. When our hero Stone was still at his mother's breast, he was already an old hand at this game of generalizing, of dividing his world into categories. His first efforts were crude and egocentric. People were friends or strangers *to him*. Objects were edible or inedible *to him*. Later, as his vocabulary grew, he took over the classifications of his culture. The patterns of stimulation that reached his sense organs were no longer just objects in space; they became apples, books, cracks, dirt, ends, and zebras. Then these and other concepts were regrouped into higher categories: animal, vegetable and mineral, vertebrate and invertebrate, fissionable and nonfissionable. Much of his time in school,

when his teachers had their way, was dedicated to the mastery of still more abstract concepts: addition, ballad, catalyst, democracy, energy, and perhaps zymurgy. Outside of school he learned how to divide people up: aviators, bureaucrats, conservatives, dunces, Englishmen, even yogi and Zionists.

Cutting obliquely across all these distinctions and casting its own specific lights and shadows upon their boundaries was always the moral illumination, now burning brightly and making the right stand out sharply against the wrong, now flickering feebly. The difference between these two categories, right and wrong, was fairly clear to young Stone when he was still under his mother's unilateral care. What was rewarded was right; what was punished was wrong. Even when he played football for Public School No. 11, the line between them bulged but did not break. He quit his first job with Green and Higginbotham, the largest credit jewelers this side of the Smokies, because the still small light yet challenged. But now he has a family to support; the race is to the swift. He manages to avoid discussion of moral issues nowadays, except occasionally when his ten-year-old son refuses to help Mrs. Stone—and then there was that interview with the editor of the high-school paper, who wanted a list of the requirements for success in the jewelry business.

The scion of an intellectual tradition is also its prisoner. For one result of all this conceptualizing is that no one past the age of thirty can look at the world with an unprejudiced eye. The sparrow's fall, the primrose by the river's brim, the burning questions of the age, are not isolated objects and events impinging upon a primitive, unprepared, and passive brain. All the day's happenings are interpreted and acted upon only after being screened through one's system of concepts, one's ideologies, and one's previously organized expectations of the world. The mind becomes a bureaucracy, which responds smoothly enough to routine events flowing through the customary channels, but which recognizes the unorthodox only after it has been edited, and recopied on the proper form, and deposited in the appropriate wicker basket.

**5. *Motives, emotions, attitudes, and interests.*** Some of the changes in a person's motivations brought about by the learning process were pointed out in Chaps. 2 and 3. A few of these are the result of condi-

tioning, as when a child, originally made happy by a visitor's occasional gifts of candy, learns to like the wrapper on the candy, the bag it comes in, the person who brings it, and even the car in which he arrives. Some are learned by organization, as when a person who fears inflation builds up a negative attitude toward a political party he believes is promoting inflationary programs. The process of generalization underlies this development, because the important attitudes are general ones, attitudes toward farmers as a class or businessmen as a class, attitudes toward a class of events, such as strikes, and toward abstract concepts and symbols, such as divorce, education, and dictatorship. Other motivations are acquired by varied activity, as when a student tries out several college courses, or when a graduate tries out several lines of work, before developing a lasting interest in any.

Although some new motives, emotions, attitudes, and interests are acquired on the basis of one's own experiences, many more come to us secondhand, from social interaction. Children are taught by their parents to fear the bogeyman and to like Santa Claus. Adults pick up most of their social and political attitudes from newspapers, radio commentators, and face-to-face local leaders of opinion. To take just one example: If David Stone joins a club or society and finds that identification (see page 151) with the group gives his ego a boost, he is likely to go to meetings and be indoctrinated in the official attitudes of the organization. If it is a national organization, he will probably subscribe to the club magazine, and he may read the articles and vote the way the national editors tell him to vote. It will be necessary, later in this book, in order to understand why people acquire the attitudes they do, to understand something of the groups they identify with and the crosscurrents of the culture in which they grow.

**6. Personal and social habits.** A *habit* is a thoroughly learned pattern of responses which, though it may have been acquired in one or two specific situations, is so well generalized that it is carried out at different times and places, in furtherance of several different motives. Most motor skills and common ways of perceiving, as in reading and searching, can be called habits. There is also a great variety of personal and social habits, habits of reaction to people and frustration, spare-time habits, habits of self-expression and self-denial, which add up to a large proportion of a person's daily life and give a characteristic color

to his personality. Although most skills, and most of the concepts and generalizations learned in school, are learned intentionally, most personal and social habits are learned incidentally (see page 153), while doing something else. Habits are essentially conservative. They are flexible enough that they can be performed under many different circumstances, yet durable enough that they make people's conduct more or less predictable.

Such habits are established in working order by all of the types of learning. Learning through varied activity, for example, may be part of the explanation for a person's habitual reaction to frustration. Frustrated once, he tried one reaction, perhaps a temper tantrum. Frustrated again, he tried another, perhaps running away. A third time he tried direct attack on the difficulty, *i.e.*, hard work and perseverance. On another occasion he tried narcotizing his troubles with alcohol, and so on. One or two of the many possible reactions may have had more satisfying consequences in respect to the motivation at the moment, and these are likely to become habitual reaction patterns. What we know about social interaction, about opportunities for imitation and identification, is helpful in understanding how a person learns social habits, like swearing, shaking hands, reacting to authority, cooperating, making a speech, and making a date.

The upshot of all this is that a very large percentage of David L. Stone's nature, and of human nature in general, is manufactured by a long and varied process of learning. Much of Stone's personality is a distillation of the cultural opportunities that he has suffered and enjoyed. If Mr. Stone had been born a few centuries ago, his hereditary equipment would be about the same as it is today, for genetic changes take place slowly, but his skills, attitudes, language, values, and anxieties would differ considerably. Many psychologists and geneticists are now engaged in an effort to catalogue those aspects of human nature which are most affected by the learning process and those which are largely hereditary, but all agree that an important fraction of human nature is culturally determined and that this portion can be modified greatly by social interaction. To dramatize the modifications of human nature over the centuries, Charlotte Perkins Stetson Gilman once wrote a poem, called "Similar Cases," from which the following two stanzas are taken: [13]

There was once a Neolithic Man,
An enterprising wight,
Who made his chopping implements
Unusually bright.
Unusually clever he,
Unusually brave,
And he drew delightful Mammoths
On the borders of his cave.
To his Neolithic neighbors,
Who were startled and surprised,
Said he, "My friends, in course of time,
We shall be civilized!
We are going to live in cities!
We are going to fight in wars!
We are going to eat three times a day
Without the natural cause!
We are going to turn life upside down
About a thing called gold!
We are going to want the earth, and take
As much as we can hold!
We are going to wear great piles of stuff
Outside our proper skins!
We are going to have diseases!
And Accomplishments!! And Sins!!!"

Then they all rose up in fury
Against their boastful friend,
For prehistoric patience
Cometh quickly to an end.
Said one, "This is chimerical!
Utopian! Absurd!"
Said another, "What a stupid life!
Too dull, upon my word!"
Cried all, "Before such things can come,
You idiotic child,
You must alter Human Nature!"
And they all sat back and smiled.
Thought they, "An answer to that last
It will be hard to find!"
It was a clinching argument
To the Neolithic Mind!

## EFFICIENCY IN LEARNING

As everyone knows, not all attempts to learn something are successful. Errors are learned too, and often what is learned is forgotten before it can be used. Errors in memorizing words and facts are usually due to interference between the many different things that one practices. Errors in organizing may be due to poor teaching and insufficient checkup on the results or to an attempt to organize too large a mass of material at once without sufficient analysis of the relationships. "Bad habits," like nail-biting, and silly errors in motor skills seem to come from practice during moments of less than perfect integration and attention. Stone, for example, though he really wants to learn to type, has his moments when he is entranced more by the uninterrupted rhythm of his finger movements and the sound of the clicking keys than by the sense of the letters they make. So before he knows it he has unconsciously practiced "hte" a few times instead of "the." It gives him a perverse little thrill, adding to the interest of a boring task, and it proves that the typing manual which a friend insisted he use is not altogether omnipotent—without, however, actually handicapping him very much in the pursuit of his more dominant life goals. Such "accidents" are more frequent when one is fatigued or distracted or torn between conflicting motives.

One ceases to improve in motor skill, of course, as he nears his physiological limit. There is no limit to the number of words or concepts that a person can learn, if he can learn one, but there is a limit to the subtlety and abstractness of the concepts and generalizations which one can comprehend.

Another obstacle to learning is a lack of flexibility. Just as learning by trial and error is inhibited by stereotyped repetition of the same things over and over, so in learning by organization the biggest handicap is a rigid adherence to one view of the matter. Likewise, if a person spends his life in one place and is exposed to only one set of ideas, customs, and moral standards, he is bound to be stereotyped in his social and political attitudes. Flexibility of activity is cut down, and stereotypy is increased, by fatigue, lack of oxygen, intense emotional upset, intoxication by alcohol and other drugs, and by certain kinds of injury to the brain.

From the principles of learning stated in this chapter, a shrewd reader may deduce several practical hints and apply them, with suitable adaptations, to his own work. In addition, psychology is able to offer the conclusions of considerable research specifically directed toward some of the actual problems of college study. The utility of these suggestions lies not in knowing but in applying them.

Practice is more effective when the learner is well motivated. If one has to learn a subject that he is not genuinely interested in, it often helps to set up intermediary goals: "I have to know this in order to do something else." And, if he keeps an open mind, he may be able to develop an interest in the subject for its own sake.

When reproduction or recall is necessary, the same control of motivation is required. The emotional upset that inhibits recall during examinations in college is usually due to fear of failure. It can often be reduced by taking failure seriously. Spend a whole day some time before the examination imagining what would happen if you fail. After that the emotion aroused by the examination may be more tolerable. Or arrange an emotional situation for yourself and practice studying under such circumstances.

One should begin a new task when he is fresh and can attend clearly to the difficult points. Errors are more frequently acquired during moments of distraction.

The learning situation should be arranged, if possible, so that the correct responses are performed more easily than errors. In the learning of motor skills, this means putting tools and raw materials in handy positions, getting a firm stance or seat to start from, and having the work in good view. In the learning of attitudes and social habits, this means having good models to imitate, living in an environment where desirable habits are rewarded.

In memorizing isolated words and facts, it is advisable to combine them into patterns or higher units, and to practice the largest unit that one can grasp without confusion.

In studying concepts and generalizations, it is helpful to think up original illustrations, to apply the knowledge to one's own experience, and to try to find exceptions to the rule. Charts and graphs that dramatize the abstract relationships are useful, especially if the learner constructs them himself. When an assignment contains many details, it is wise to skip the details at first in order to grasp the over-all organiza-

tion of the material. Once the structure of the topic is outlined, the details can be fitted in more economically.

The guidance of an expert is more advantageous at the beginning of learning, when critical errors may be made, than later. Positive hints are always better than negative.

Practice is usually better when broken into short periods and spread over many practice periods, than when all crammed into one binge. The most effective period of practice will be longer for some people than for others, naturally, but for simple monotonous learning, like memorizing poetry and practicing ice skating, periods as short as 20 minutes may be desirable. The best period for studying bridge or chess would be much longer.

To prevent forgetting, one should review frequently. Spend a larger portion of study time on recitation than on original acquisition. In learning motor skills, set a specific goal in terms of speed or accuracy and work toward it.

Retroactive interference, the chief cause of forgetting, can be combated by two methods. Overlearning, *i.e.*, continuing to practice a little longer, even after attaining that pleasant but deceiving feeling of familiarity with the material, is helpful. The interference can be eliminated also if one identifies the possibilities of interference, the terms that are used in two different ways, the generalizations that seem to conflict with each other, and gives them some extra practice.

*Mnemonics*, little tricks for organizing arbitrary unrelated words and facts, are sometimes valuable, especially if the learner constructs them himself. If one knows, for example, that there are two kinds of vision, color vision and twilight vision, and two kinds of receptor cells, rods and cones, but cannot remember which goes with which, a scheme like $\begin{array}{|c|l}\hline \text{co} & \text{nes} \\ \text{co} & \text{lor} \\ \hline \end{array}$ may settle the confusion.

Periodically, as learning progresses, the complete performance should be analyzed, as close to actual operating conditions as possible; then practice should be directed toward the weak spots.

The application of modern principles of learning to education, to industry, and to the training problems of the Second World War led, in many cases, to remarkable reductions in learning time, errors, and wastage. Progressive engineers now realize that, whenever physical research designs a new instrument, or tool, or machine for the service

of mankind, psychological research is necessary to discover how actual men and women can get the most out of it. A much more efficient procedure, which has only recently been put into operation, is to bring psychological research to bear upon the problem *before* the instrument is designed.

## INDIVIDUAL DIFFERENCES—WHY SOME PEOPLE LEARN MORE THAN OTHERS

The influence of learning is a precarious one. It changes some people tremendously during their threescore years and ten; others live their lives relatively unmolested. The growth and decline of an organism's hereditary potentialities, of sexual function, and of energy output, for example, occur quite regularly in all members of the species, but any learned activity, like reading, smoking, and loving peace, may be acquired or not, depending upon motivation, opportunity, practice, and the ability to profit by these. People do not learn to type unless (1) they want to, (2) they have access to a typewriter, (3) they actually sit down and work at it, *and* (4) they start off with a certain aptitude for typing. Hence, people vary widely in the amount and kind of things that they learn during their exposure to the many different cultures that have taken root on the surface of this gradually cooling spheroid, and the remainder of this book will demonstrate, with specific instance and analysis, how the principles of learning, outlined in this chapter, influence people's thoughts, their social relations, their accomplishments, and their personalities.

As a general statement, it is true that ability to learn rises in the first two decades of life, then slowly and comfortably declines, along with the size of the brain and the general reactivity of flesh and blood. The graph on page 331, showing intelligence-test scores at different ages, could just as well represent the graph of learning ability. But the details are more interesting than the general trend. The typical adult does not learn in the same manner or with the same gusto as the typical child. He approaches a novel task with circumspection, conscious of his dignity and his prior commitments, depending less on activity and more on organization, as befits his age and his blood pressure. (Though he may not be flattered to know it, exactly the same difference is observed

when young rats and cats are compared with their elders.) Since adults' interests are more specialized than children's, they cannot be motivated so easily; their attitudes are less flexible. Adults are less suggestible than children; they consult their own intentions as well as their instructors'. As a result some will acquire conditioned responses readily, others not at all.[14]

It is also true, as a general statement, that the more intelligent half of the people learn better than the lesser half. They learn better, but not necessarily faster. Even white rats, who are not particularly bright, can learn some simple things as fast as human beings. When psychologists run their rats and their college students through similar mazes, the college students do not reduce their errors much more rapidly than their four-legged competitors. But all human beings can learn some things which the rats, though they may burn the midnight oil with their customary nocturnal vivacity, can never learn. The signal importance of intellectual ability lies in the setting of limits to the difficulty or complexity of the task one can learn, not in the speed of learning it. Furthermore, the significance of general intelligence in the life of the average adult has been somewhat overrated. Maturation, education, and vocation divide people up. Their enthusiasm and their talents flow out through many diverging channels, so that the useful things to know, if one wants to predict what an adult can and will learn when given the opportunity, are his age, his interests, and his special abilities, such as artistic talents, facility with numbers and with words, comprehension of spatial relations, and dexterity with the hands.[15] General intelligence comes into its own when the material to be learned consists of abstract concepts and generalizations, the stuff that schoolbooks are made of.[16] White rats and morons can learn to grasp levers—in psychological laboratories and in voting booths—but neither can grasp the complicated pattern of mechanical and human relations that put the levers, and themselves, where they are.

## SUMMARY: PRINCIPLES OF LEARNING

Unlike maturation, learning requires practice. Evidence for learning comes from controlled observations of behavior before and after practice.

For experimental analysis, the complete learning process is usually

broken down into three phases: acquisition, retention, and reproduction.

Acquisition of new response patterns occurs in four ways: varied activity, conditioning, organization, and social interaction. These four types of learning differ in several respects, but they are alike in that all occur only in situations that offer certain definite opportunities, they all depend upon integrated activity of some sort, whether muscular or intellectual, and in all forms what is learned tends to spread to other similar situations.

Learning curves, which are graphic records of changes with practice, usually show negative acceleration, a slowing down of rate of improvement as the learner approaches a limit. The limit may be a permanent physiological limit or a temporary artificial limit, which may later be surpassed. A few learning curves show positive acceleration at some stage of progress.

Imperfect retention, or forgetting, of what has been acquired is usually produced by interference from the learning of something else. Some forgetting, however, comes from electrical, chemical, and mechanical disturbance of brain tissue.

The final manifestation of what has been acquired and retained, which goes by such names as reproduction, recall, and recognition, is influenced, for better or worse, by emotional conditions and by the motivation for reproduction, for we tend to repress what is distasteful and to use the remembered material for a variety of diverse purposes.

The many variegated things that people learn can be grouped into six classes: motor skills, perceptual habits, words and facts, concepts and generalizations, motivational trends, and social habits. The formation of concepts lays the basis for man's extraordinary intellectual accomplishments, while the formation of social attitudes and habits stabilizes social, economic, and political activity.

From the general principles of learning and from special experiments, several rules for efficiency of learning have been developed. Modern knowledge of learning has reduced training time and errors in a number of critical human enterprises.

From the cradle to the grave everyone is influenced by the learning process, but some people are affected more than, and in different directions from, others. Important factors, which decide what a person learns, are the opportunities offered by the culture in which he lives,

his motivations, and his aptitudes. Age changes motivations, aptitudes, and style of learning.

There seems to be no general all-round aptitude that speeds up learning in all fields. General intelligence is related to individual differences in learning, not so much in respect to speed of learning but in setting an upper limit to the abstractness of the concepts and generalizations a person can comprehend.

### TECHNICAL TERMS FOR SPECIAL STUDY

maturation
learning
acquisition
retention
reproduction
varied activity
trial and error
law of effect
reinforcement
conditioned reflex
conditioning
unconditioned stimulus
conditioned stimulus
organization
insight
learning by insight
social interaction
imitation
identification
instrumental conditioning
incidental learning
generalization
differentiation
random fluctuations
negative acceleration
physiological limit
positive acceleration
plateau
nonsense syllables
retroactive inhibition
recall
recognition
relearning
savings method
memory image
repression
transfer of training
overlapping
higher units
perceptual learning
illusion
verbal learning
rote learning
memorizing
concept
induction
abstract concepts
principle
law
habit
mnemonic

# 8

# THOUGHT AND JUDGMENT

Thought is an elusive mistress; even he who woos her most expertly may end with only a cliché to caress. Pursuit of the charm and essence of thought is a baffling scientific undertaking, not because the quarry conceals herself too well, but because she so frequently changes her guise. The term *thought* means different things to different men, and different dictionaries, but a good deal of the confusion can be cleared up if we take time to separate out three rather distinct meanings of the term.

1. *Thought as the content of consciousness.* This is what people mean when they ask "What's on your mind?" and offer "a penny for your thoughts."

2. *Thought as problem solving.* As opposed to muscular action, thought is a reflective or deliberative activity. It is what one does when faced by a problem, when he has to "stop and think." In this sense thought occurs only as brief and infrequent episodes during an active life. The psychological study of problem solving has been directed chiefly toward an analysis of the thinker's activities, his thought processes, and what helps and hinders them while he is working on his problems.

3. *Thought as judgment.* "I don't know for sure, but I think. . . ." Thoughts in this sense are the opinions, beliefs, judgments, or conclusions reached by thinking and, as such, they mark the end of a thoughtful episode, even though the beliefs may be held, and announced to others, with less than complete certainty. The psychological study of judgment has been directed chiefly toward uncovering the determinants of the final judgment, what there is in the thinker's past and what there is in the present situation which slants the conclusion this way and that.

## 1. *THE CONTENTS OF THE MIND*

Not so long ago, when psychology was young, its chief business was the analysis of man's consciousness. Since the only consciousness one can know is one's own, psychologists trained themselves to look deeply into their minds and report what they observed there, the inner experience and mental images of smells, sights, and sounds, sensations of muscular strain, feelings of pleasure and pain, and the tingle of anticipation. Just as so many other sciences have been misled in their youth, enthusiastic young psychology was taken up a blind alley by this introspective technique (see page 111), partly because two psychologists, both well trained and serious, could often give opposing reports of what happened. The climactic instance of this fundamental difficulty occurred some years ago at a meeting of the Society of Experimental Psychologists, when two of the most eminent psychologists of that day were debating the nature of the mental impression coming from a green object. The one said: "You can see that green is neither yellowish nor bluish!" To which the other replied: "On the contrary, it is obvious that a green is that yellow-blue which is just exactly as blue as it is yellow." As Professor Boring of Harvard University, who reported the incident, says, "That impasse was an ominous portent of the fate of introspection. When two distinguished experts could disagree vis-à-vis about so basic a matter as the nature of hue, some other method of approach was needed." [1]

No doubt the case has been overstated. A man's report of his feelings is a useful bit of information—to the dentist and to the shoe salesman at least. Psychologists today are interested in reports of inner experience as well as observations of outward action, particularly because the former may help to explain the latter, but since reports of thoughts, motives, memories, and passions are so notoriously unreliable, they do not take these reports at face value. Present practice of careful psychologists is to put these subjective reports and the returns from more objective sources into the same calculating machine, to be analyzed and checked against each other according to the conventional canons of scientific acceptability.

Furthermore, in many areas of psychology, investigation of a man's thoughts, even when honestly and carefully expressed, yields very little

of scientific interest. As a man learns a new task, for example, his activities become automatized and he actually devotes *less* thought to the task. Many memories and thoughts are repressed, often the most significant ones. And, if a man's thoughts flow rapidly, as they do when he is intrigued by a complex problem, he simply cannot report everything the forceps of his mind momentarily grasp and pass on in spirited sequence.

***The free play of thought.*** For these very good reasons psychologists no longer expect to unravel the mysteries of the mind by subjective analysis. But the contents of consciousness—those sudden visitations of happiness, fugitive glimpses of the meaning of the universe, tender recollections of a lost love, and frightening forebodings of danger ahead—all these, as well as more prosaic sensory impressions such as the sights, sounds, and smells arising from home and office and workshop, are still valid psychological phenomena, well worthy of scientific study for their own sakes. This lush vegetation of the mind appeals more to novelists—who have written out of and about the "stream of consciousness"—and poets than to psychologists. Psychologists discuss these phenomena under the heading of attention, as in Chap. 5, pointing out that what people think about, or attend to, depends partly on environmental stimuli and partly on motivating conditions. Attention is caught by loud sounds and other intense stimuli, and by stimuli associated in the present or past with vivid emotional experiences. When a person is actively doing something, trying to solve a problem, for example, his motivation controls his attention, at times even resisting strong distraction. When one's mind is at rest, and his thoughts playing freely among themselves, ideas, memories, associations, fantasies, images, plans, hopes, and dreams roll by and carom off each other in luxuriant but often unrewarding display. One's reverie is at the mercy of stray impulses from anywhere, the most ridiculous fears, the wildest hopes, and the remotest associations sending the fancy out far and wide, unhampered by the vulgar constraints of reality. The technical term for this reverie is *autistic thinking*.

The free play of thought, or thought not directed toward any particular goal, can be illustrated painlessly if the reader will lean back in his chair, close his eyes, think of the word "cut," and just let his thoughts go. The first thing that comes to mind may be the image of a cut finger, then a cringe as pain is imagined. Or, for someone else,

the first reaction may be a word, like "wage," then he thinks of "bills" and "groceries." "Groceries" leads to "store," and that leads to "attic," which suggests "insulation," then "wire," then "Western Union," and so on. Here we see thought wandering along, making its own way among memories, desires, fears, and associations. Although this kind of mental activity, since it is not directed toward a previewed goal, rolls this way and that like a pinball in a nickel machine, still it is not entirely a haphazard activity. Say the word "chair" to a large number of literate Americans and about 45 per cent will reply "table." Say "pin" and some 38 per cent will say "needle." Say "black" and 55 per cent or so will come back with "white." The reason for this uniformity is, of course, the common association of these pairs of words in ordinary language.

The ideas and memory images (see page 167) that course through an alert mind in such a lively fashion are largely the products of past learning, and the process of recalling them from that past is known as *reproductive imagination.* Just as one may attend to, or focus his thoughts upon, anything that he can comprehend—the taste of a Baldwin apple, the appearance of the moon's surface, the possibility of life after death, the statistics on suicide, or the distinction between murder and manslaughter—so may he, if his memory serves him, reproduce any of these thoughts in imagination. Much more rare is the process of *productive imagination,* the creation of new ideas, or new applications of old ideas, to fit specified requirements. Both kinds of imagination flourish best out of a rich background of experience, but the creative function is a very special and valuable human activity, which plays a critical role in another sort of thoughtful enterprise, the solution of problems.

## 2. THOUGHT AS A WAY OF SOLVING PROBLEMS

Here is food for thought in 10 courses:

*Problem* 1. A woman, driving a car in strange territory, comes to a fork in the road and stops to think which way she should turn.

*Problem* 2. Write words and music for a United Nations anthem.

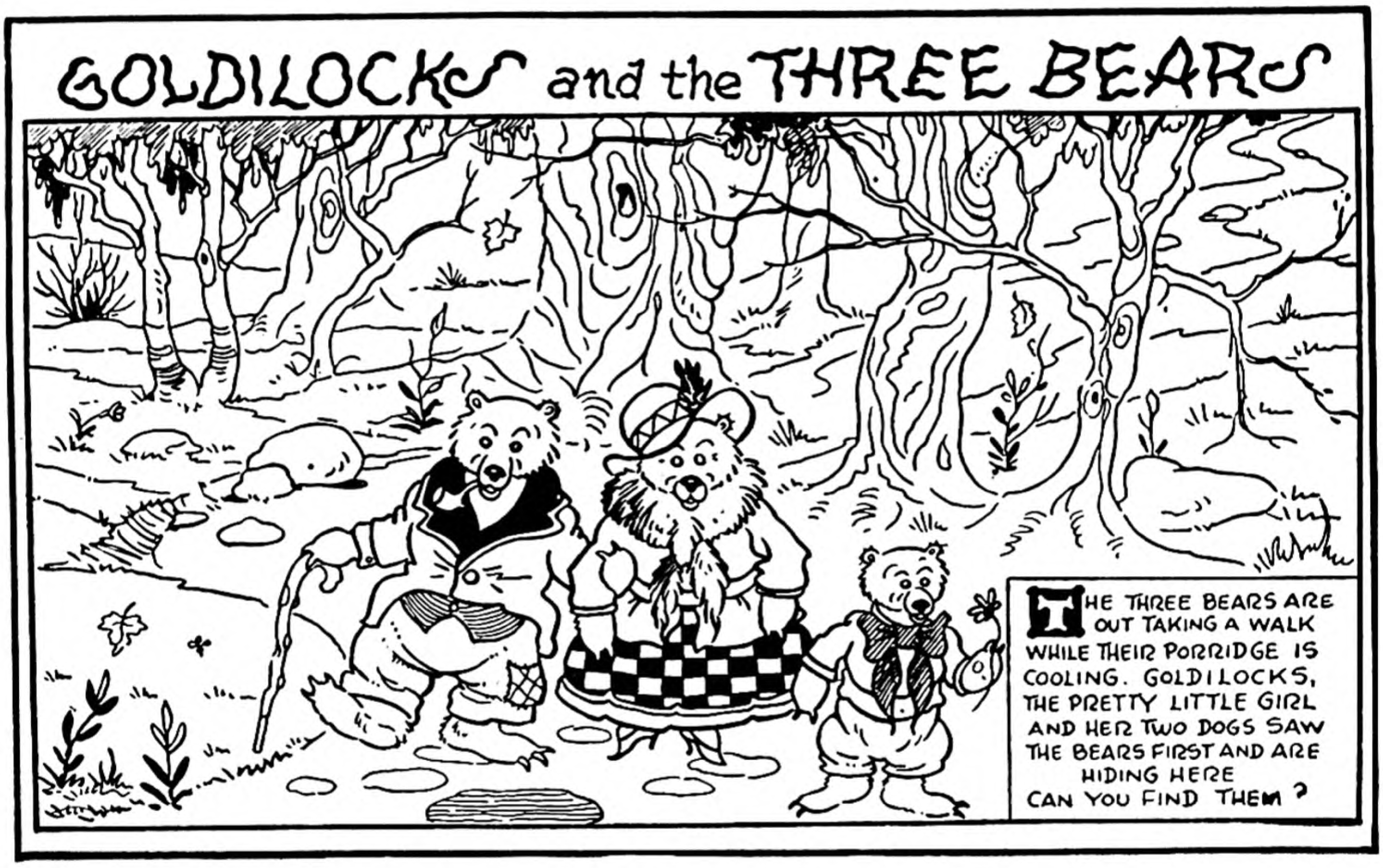
*Problem* 3. A girl who was very popular in high school goes to college and finds that no one pays any attention to her, that she cannot get good grades, and that she does not know why she is in col-

lege anyway. Which way will she turn to regain satisfaction and self-respect?

*Problem* 4. What is a five-letter word which means the opposite of good?

*Problem* 5. Draw a quadrilateral of such shape that you can draw a straight line through all four sides.

*Problem* 6. See Fig. 81.



THE THREE BEARS ARE OUT TAKING A WALK WHILE THEIR PORRIDGE IS COOLING. GOLDILOCKS, THE PRETTY LITTLE GIRL AND HER TWO DOGS SAW THE BEARS FIRST AND ARE HIDING HERE CAN YOU FIND THEM ?

Fig. 81. A puzzle picture. (*Courtesy Publication Enterprises.*)

*Problem* 7. A man and his wife together are ninety-eight years old. He is twice as old as she was when he was the age that she is now. How old is each?

*Problem* 8. Would it be good business, under present conditions, for a department store, which is the smallest of five in a town of 30,000, to start an expansion program?

*Problem* 9. Take a man's vest off without removing his coat.

*Problem* 10. Whom shall I vote for?

One of the toughest assignments ever given to any science is the analysis of the activities of human beings solving their human problems. Everyone will admit that purposeful thinking, in the sense of problem solving, is a strenuous activity, which people do not carry on often, nor for very long at one time. Since, however, what goes

on during a man's occasional reflective pauses at the crossroads of decision often exerts a controlling influence on his subsequent career, everyone will also admit that the psychology of reflective thought deserves thorough scientific investigation.

*A distinction between problem solving and learning.* The psychology of problem solving and the psychology of learning have much in common, for both include the acquisition of new response patterns. The distinction is one of convenience, like the distinction between medieval and modern history. The topic of learning deals with a longer time span than the topic of problem solving, covering the effects of repeated practice and the retention and reproduction of what has been learned. Under the heading of problem solving, we are interested in human activities in a problem situation, even though the responses or solutions may be performed only once or twice. Terms from the chapter on learning, such as varied activity or trial and error, and organization or insight, will be of use in our discussion of problem solving, but we shall try to go deeper into these ways of acquiring new responses in order to see what activities are varied, and organized, and, if possible, to describe how and why.

A superficial description of the problem-solving process is relatively easy, for the solutions of many problems have much in common, in general outline at least. Let us tune in on the thoughts of Mrs. De Giacomo in the throes of Problem 1. She is driving along, let us say, rehearsing the informal talk she is planning to make for the Hillsdale Garden Club. The first pertinent change in her thoughts occurs when she sees the fork in the road ahead. With the realization that she has a problem in front of her comes a redirection of her attention away from her speech and onto her present difficulty. It is a general rule that, when a genuine problem arises, attention is focused on the obstacle that interrupts the routine activity. As to what happens next, there is no general rule, except that she will try many things. She may look down each road for a sign. She may rummage through the glove compartment for a map. She may hunt through her bag for that letter from the program committee. Her thoughts may travel back to an image of a map her husband showed her before she left home or to the advice given her at the last filling station. She may even try to construct in her mind's eye the lay of the land and from that read off the general direction of Hillsdale. Unless she is unusually distraught, she does not think of everything at once. Prob-

ably she will try one approach after another, sticking to each as long as it seems fruitful. When she is looking down the road for signs, what attracts her attention will be telephone posts, advertising signs, and anything else that resembles a signpost. Objects in the environment that are obviously not pertinent will be ignored. Sooner or later she will make a definite move. She may recall or infer enough to decide for one road or the other. She may flag a passing car or drive up to the nearest farmhouse for directions. Or she may take either road tentatively, hoping to see a helpful signpost as she goes along. In any event she does something that concludes the energetic uncertain business of thinking.

Certainly Mrs. De Giacomo's problem is a very simple, minor problem. When the problem is a complicated one, like writing words and music for a United Nations anthem (Problem 2), it is usually broken up into several parts, each of which may be a major or minor problem by itself. If the first part-problem considered is the best way to begin, the thoughts generated will be some such as inspecting other patriotic songs, securing paper, going to the library, and arranging for a place to work. When that phase of the larger problem is settled or becomes unpleasant, one might consider a second part-problem, the specific requirements to be met. What comes to mind then might be a series of characteristics like length, style, level of difficulty for singing, popular appeal, theme to be emphasized, and language to be used. Then one might turn to other parts of the general problem. What form should it take? What are the dangers to be avoided? Should the music be written first, or the words? Each of these may be definitely settled in turn and forgotten, but more frequently the thinker goes back and forth, working now and then on each of the part-problems, and retaining in the back of his mind a general orientation to the problem as a whole. The solution of a complicated problem takes on a serial form, internal problems being raised and settled, either tentatively or permanently, all along the way.

The motivations behind thought are as varied as the motivations behind any other activity, for a barrier to one's activity, however that activity may be motivated, raises a problem. Problems are tackled for the sake of money, prestige, and self-defense, among other reasons. And some people enjoy working puzzles for their own sake, out of pure intellectual curiosity. Motivation in the realm of thought,

as elsewhere, is usually multiple. The girl in Problem 3 will be motivated in several ways, some of which will be unconscious. When the problem is to think up an excuse for a course of action already decided upon, the motivation goes by the name of *rationalization.* The history of thought gives many examples of philosophies, ethical systems, legal concepts, economic theories, and other ideologies that have been developed as justification for military action, for the whims of a reigning monarch, for the injustices of the *status quo,* or for reform movements. Thought is a flexible tool, an adjustable, all-purpose, universal but fallible instrument at the service of any of man's motives, good and bad, conscious and unconscious.

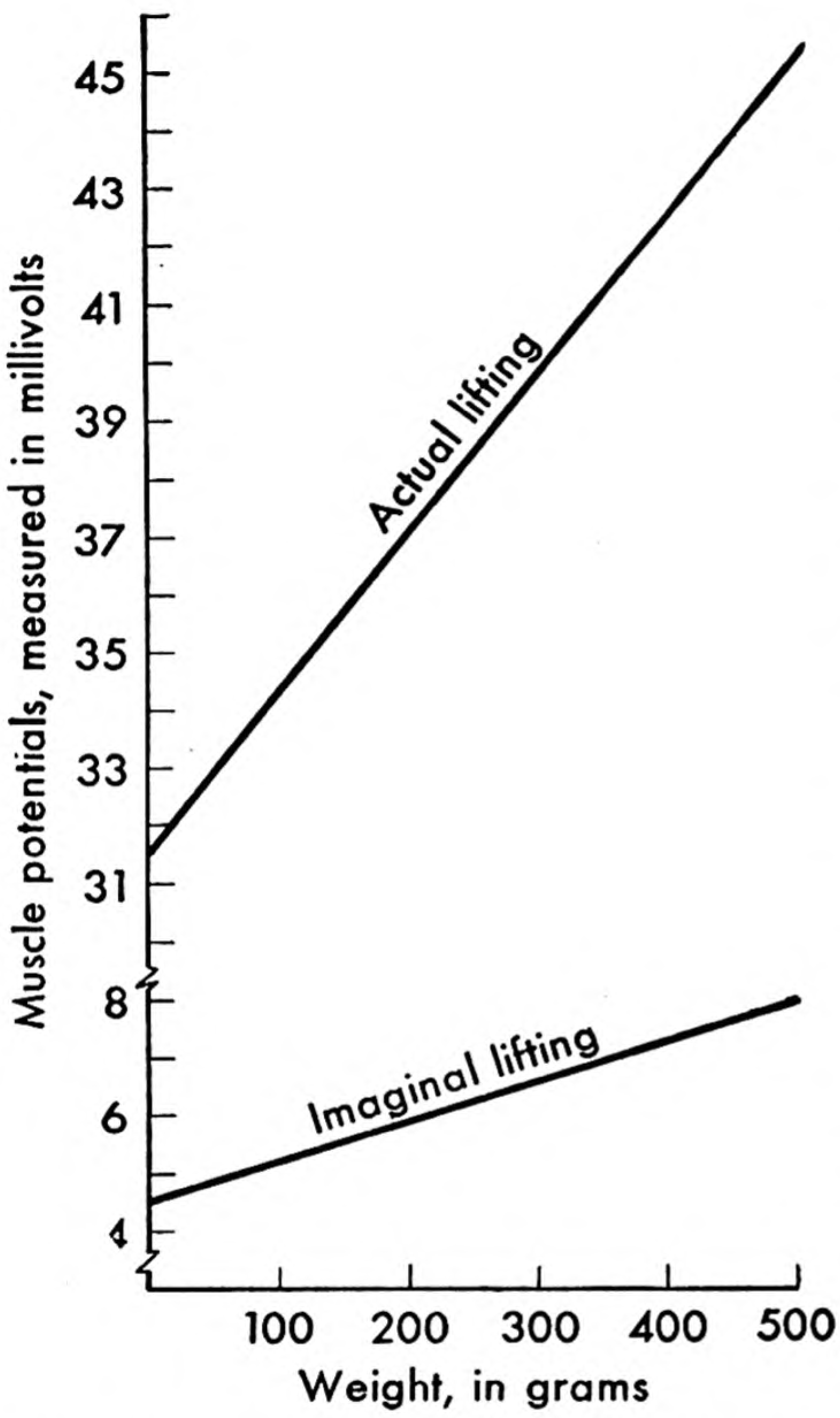


Fig. 82. Electrical currents in the arm muscles of one subject during actual and imaginal lifting of five weights. (*Redrawn from W. A. Shaw.*[2])

What makes the scientific investigation of this variegated activity so difficult is that much of it is subjective or mental, and thus not visible to an outside observer. Mrs. De Giacomo's hesitation, her knitted brows, and her fumbling for map and letter can be observed externally, but the bulk of the activity is internal; she manipulates concepts and images "in her head," and anticipates in imagination the consequences of her decisions. It is true that when one is asked to "think of" something, there will be a change in the brain-wave pattern (see page 90) and in electrical currents in various muscles of the body. Except for the fact that muscle currents are larger when one thinks of lifting a heavy weight than when he thinks of lifting a light one,[2] these changes are about the same whatever one thinks of (see Fig. 82), and they therefore offer us little immediate help in trying to describe how problems are solved. The only way at present

of tracing the solution of problems is to ask the thinkers to talk about their thoughts as accurately and completely as possible, then to compare their reports with their solutions, their errors, and the time taken, and to arrange experiments by which conclusions from their comments can be checked by more dependable data.

***Setting up the requirements.*** Watching thinkers in action and listening to their comments, a careful observer can often identify a period of preparation early in the problem-solving process. If it is a mechanical problem, the materials and tools are assembled, their properties and potentialities are inspected. If it is a mathematical problem, the given data are put together and organized, if possible, so that the requirements of the problem will be clearly grasped. The popular epigram, "a question well put is half answered," has been experimentally proved true. In Problem 4 the requirements are clearly stated at the outset, but if the problem has many angles, the thinker often begins by taking stock of what he has to work with, eliminating what appears irrelevant, and setting up the requirements of the problem, or of a convenient segment of the problem. "I need something about so long to fit in here." "I am looking for a word that rhymes with 'world.' " "What is lacking is a method of doing this without upsetting that."

***The flow of ideas in productive thought.*** A spell of reflective thought has a definite beginning, in the realization of the problem and the focusing of effort on that problem, but once the wheels begin to grind, anything can happen, in any sequence. If it is a simple problem, like naming a five-letter word that means the opposite of good (Problem 4), which one can grasp as a whole, one commences immediately to think of words, one after another, and tests them against the two requirements of the problem. Or, in the case of a problem like 5, one may begin by dreaming up quadrilaterals of various shapes or by rehearsing the problem requirements.

Ideas, acts, patterns, points of view, and new ways of organizing the facts are brought to mind, tried out, then accepted or rejected. Hence all thinking has a trial-and-error character. But, for some reason which has intrigued psychologists for years, the ideas that come to mind are more or less pertinent. Thought does not reach blindly into the deep store of memories as into a grab bag. Once the thinker understands the problem or part-problem, and can visualize or preview the

kind of movement, idea, word, or design that the problem requires, he is usually able to inhibit the grossly unsuitable and produce potentially useful thoughts. Goal-directed mental activity, like goal-directed muscular activity, is guided by an integration or set of the nervous system (see page 4).

Many problems are like jigsaw puzzles, or the puzzle of Goldilocks and her dogs (Problem 6), in which productive efforts consist in thinking up new ways of organizing data already visible, new meanings or insights for facts at hand. The ideas that are useful in working these problems, as well as the one about the ages of a man and his wife (Problem 7), are relationships and combinations of the given facts. At a high level of complexity, as in the problems of business (like 8), industry, and politics, as well as in science and philosophy, facts and figures come to mind, various patterns of these are tried out, and then new material often must be collected before the situation is straightened out. It is true that most patterns of ideas, most concepts and generalizations, are learned from others, as children learn the concept of "apple," and as medical students learn the pattern of symptoms in pneumonia. But originally someone—and these are the thinkers on whom the burden of progress rests—had to construct a coherent pattern, or generalization, or principle from previously unorganized facts.

It is a common tendency, and a comfortably lazy one, to claim that thought is a lawless will-o'-the-wisp, an intangible, which cannot be snared by the precise methodologies of science but must be either courted on a wind-swept hill or passively worshiped from afar. Intangible it is, but no more so than solar energy, and the progress of science has always consisted largely in making intangibles tangible and reducing them to number and order. As a matter of fact, one of the laws that govern the production of ideas has already been worked out and stated with mathematical precision, for the simpler cases at least. For the same reason that geneticists like to study animals that breed abundantly, psychologists like to study thought under conditions that encourage abundant output. Bousfield and Sedgewick, of the University of Connecticut,[3] were able to secure an abundant flow of thoughts for analysis merely by asking college students to sit down and think up words to fit certain simple specifications. Whether the instructions

were to think of names of fellow students, quadruped mammals, automobiles, or of pleasant and unpleasant associations, rate of production followed a fairly definite law. Output began rapidly, with the more familiar names being put forth first, then gradually slowed down as the limit of the supply was approached. Figure 83 shows that names of fellow students were produced fluently, because there were so many on tap in their memories, while names of animals came to mind more slowly. Rate of production was quite regular, with output in any 2-minute interval being a fairly constant proportion of the number available in reserve. This is another of those cases, so common in all sciences, like learning to type (see page 157), in which repeated measurements indicate regular approach to some sort of limit.

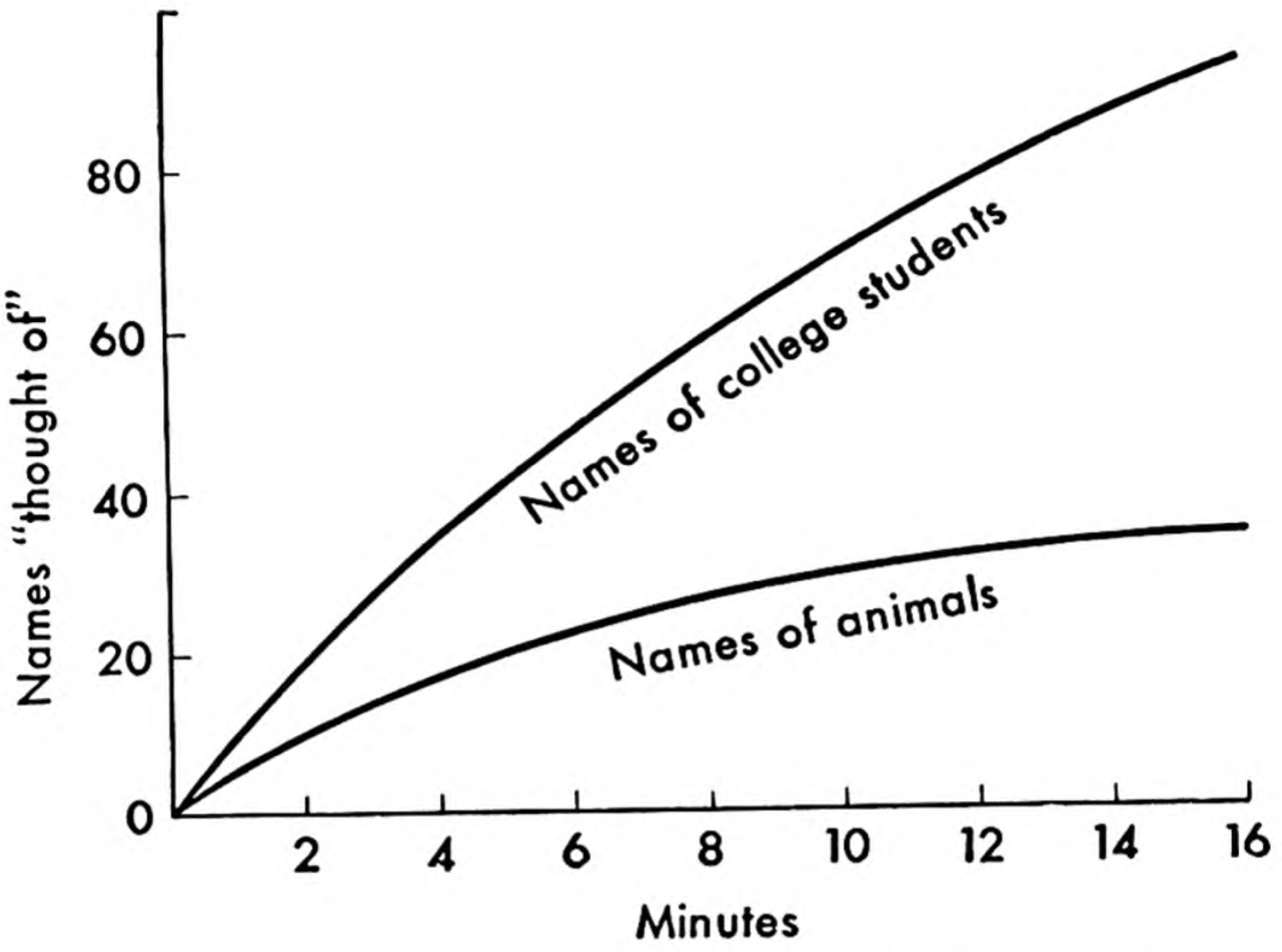


Fig. 83. Rate of production of words. College students were asked, in one experiment, to think of names of fellow students and, in the other, of animal names with two or more syllables. Average flow of words was quite regular and can be described by an exponential equation. (*From Bousfield and Sedgewick.*[3])

The production of words is a special case, as neat scientific demonstrations usually are, but there is no reason to expect that the production of more abstract thoughts, like programs of action, hypotheses, implications, and reorganizations of the facts, would follow a different course if their rate of production could be recorded. Output per minute would certainly be smaller, but production would still be relatively rapid at first, and would slow down as the reserve is gradually depleted. During the productive thinking of real life, when ideas

are being elaborated to meet the specifications of a practical problem, the thinker evaluates the ideas as they come to him, so this productive process will be halted when one comes to mind that looks worthy of trial. (That is why it is correct to say that all problem solving has a trial-and-error character.) Also most people, unless they are unnaturally persevering, do not exhaust their store of ideas on any topic in one deluge of productivity. When the flood of ideas flowing through any channel thins to a trickle, people usually change their approach, tentatively or permanently, and take off in other directions, perhaps visualizing the problem in a new way, and dreaming up ideas for another phase of the over-all problem. Furthermore, since the human machine operates at peak performance only during moments of complete physiological integration, these productive episodes are continually interrupted by vulgar thoughts of time for lunch and the other calls of nature and society, by daydreams of prizes for creations not yet created, and by anxiety over deadlines rushing closer. The most annoying intruder into the direct flow of pertinent thoughts during problem solving, however, is the free play of thought, which occurs when words, images, and programs of action, becoming intrinsically attractive, lure the thinker into disgraceful consort with ideas for their own charm and plasticity, and carry him off on tangents of memory and association. For all these reasons the picture drawn here should be viewed as just one phase of a complicated zigzag procession. A more true-to-life picture of the flow of ideas in productive thought can be conceived by putting several graphs of this sort end to end, interspersed with ramblings up and down the byways of reverie.

**Reasoning.** *Reasoning* is more a logical than a psychological term. As extended to psychology, it seems to mean the production of ideas, thoughts, or solutions which, unlike the random words, facts, and movements sometimes produced by varied activity, have a reasonable or logical relation to the requirements of the problem. The data at hand are organized into a pattern, and the production of a solution that fits this pattern takes place with relatively little trial and error.

Mary is taller than John.
John is taller than George.
Jane is shorter than John.
Which girl is taller?

People usually reach solutions to problems like this by assembling the relations between Mary and John and between John and Jane into a straight-line pattern, as in Fig. 84, from which the relative heights of Jane and Mary are immediately apparent. Many people actually report a mental image of such a pattern. George will cause a little trouble, but his existence will soon be recognized as superfluous just because he does not help to clarify the pattern of relations between the two girls.

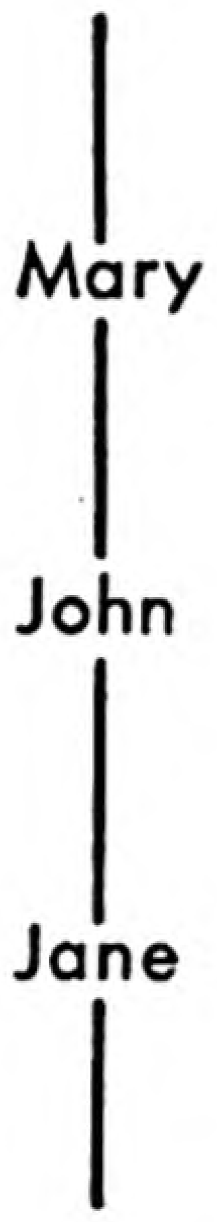


Fig. 84.

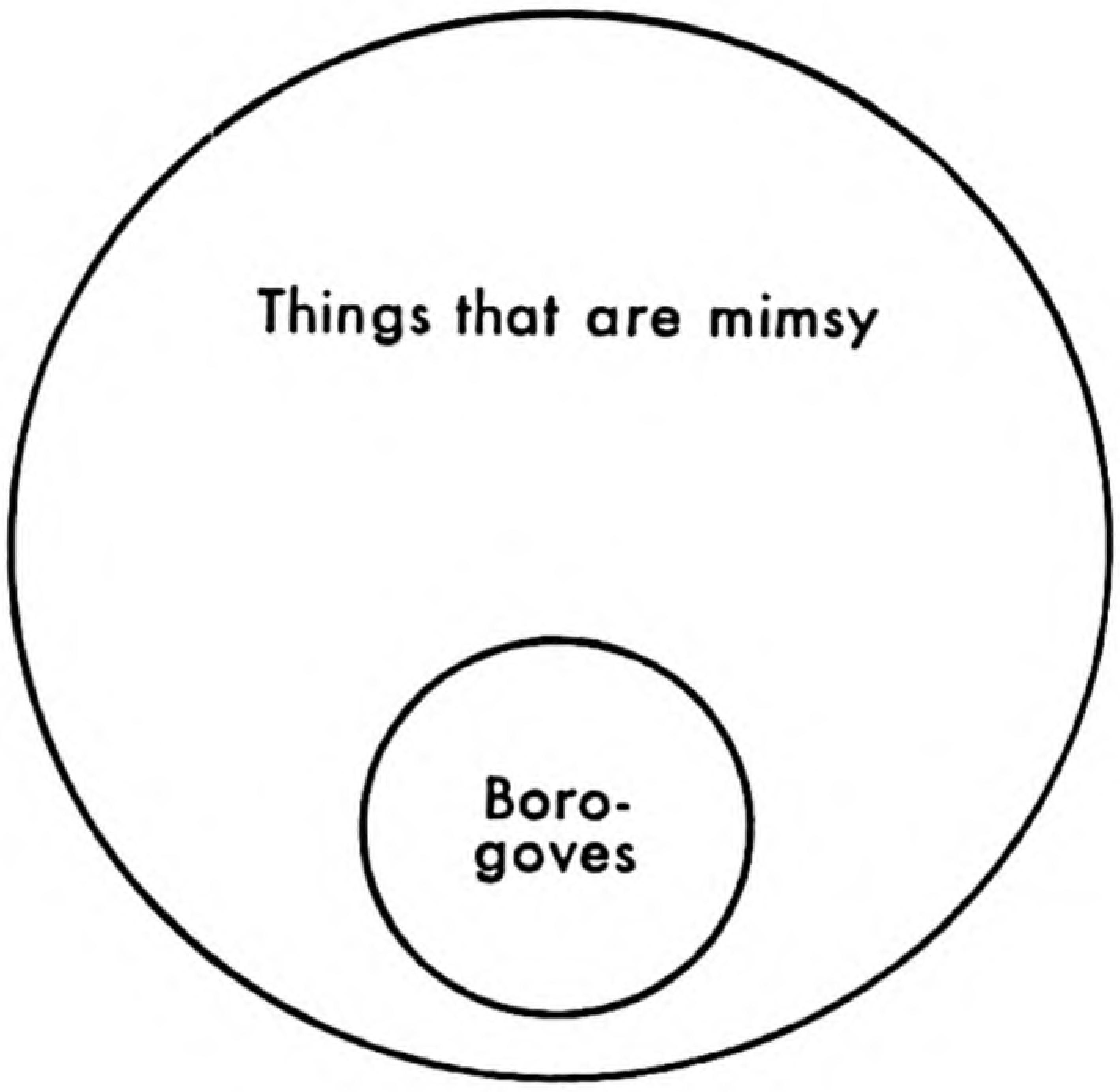


Fig. 85.

Fig. 84. One way of putting abstract relationships into a visual pattern.

Fig. 85. Another visual pattern of logical relationships. Logicians call these visual aids "Euler's circles."

If the problem is to find how much two pieces of candy cost, knowing that one piece costs 1 cent and three pieces cost 3 cents, one would think, quite reasonably and logically, of 2 cents. To the average adult in our culture, such reasoning is obvious or "self-evident," but actually it depends upon the mastery of the relations indicated by the concepts "taller than," "shorter than," and "costs," as well as those highly generalized concepts "one," "two," and "three," and the precise relations between them. The highest type of reasoning is carried out with abstract symbols, like words, numbers, and other concepts, which are combined, analyzed, and otherwise manipulated according to certain rules or generalizations about logical relations. The reasoning done today is, of course, a consequence of centuries of trial-and-error evolution of logical relations. These relations are quite easily

learned and well retained, however, because they are not arbitrary, like unrelated names and telephone numbers, but are based on the primitive tendency of the nervous system to respond to relations and patterns.

The *syllogism* of formal logic illustrates a well-known way of organizing the facts and reaching a reasonable solution to a question about these facts.

> If all borogoves are mimsy,
> And Kilroy is a borogove;
> Then what can we say about Kilroy?

The logicians have worked over many patterns of relations like this example and have established rules for handling them. Representing the facts and their relations by a diagram often makes the inferences clearer (see Fig. 85). Placing the borogoves entirely within the circle of things that are mimsy sets one relationship down in black and white, from which it is obvious that anything in the borogove circle must be mimsy.

One must beware of exaggerating the difference between reasoning and the less highly respected ways of solving problems. The difference is one of emphasis. Even thinking in which one thing after another is tried, apparently with reckless flouting of logical restraints, will contain an element of logic when carefully examined. And in the highest forms of reasoning there is always some trial and error, in selecting the approach, in choosing a way of organizing the data, in deciding what is relevant, or in interpreting the original question.

**Creative thought.** *Creative thought* and reasoning are similar in that both are directed toward a goal, in contrast to the free undirected play of thought in reverie. [Creative thought, creative imagination, productive imagination (see page 196), and productive thought, all have about the same meaning.] The differences between reasoning and creative thought are in outcome and procedure. Thinking is usually called creative if the outcome is original. Originality has both a personal and a social definition, of course, for many a man has put in much creative work on an invention, or a song, or a merchandising scheme, only to discover that someone else had done practically the same thing a year earlier. As to procedure the chief difference is that reasoning follows a rather straightforward course, through deep,

perhaps, but well-marked channels, whereas creative thought travels its own way, progressing toward the goal, if it does, by irregular and unpredictable advances. Creative activity is characterized also, more than reasoning, by incubation and illumination, two of the most fascinating phases of thought.

*Phases of creative thought.* In spite of all the irregularities and peculiarities of procedure in creative thinking, several acute observers, of their own thoughts and others', have agreed in identifying four phases: preparation, incubation, illumination, and revision. One psychologist, Catherine Patrick, has been able to obtain more or less objective evidence for these phases by asking poets and artists, as well as untrained students, to write a poem, or draw a picture, or plan a psychological experiment.[4]

*Preparation* is the initial phase of organizing the data at hand, setting up the requirements of the problem, and the production of pertinent ideas or thoughts. It usually begins as soon as one brings his thoughts to focus on a problem and can be identified by looking over the poet's or artist's shoulder and noting the occurrence of new thoughts or directions of activity.

*Incubation,* which is often the next phase, consists of "the spontaneous recurrence from time to time of a mood or idea with more or less modification, while the subject is thinking of other topics." [5] Many artists, scientists, and inventors have testified that they often incubate an idea for months—working on it occasionally, then forgetting it temporarily—before it develops into a usable product. Even when a poem is written to order, for an inquisitive psychologist, the basic ideas of the finished poem may be thought of in the first few minutes, then discarded in favor of others, then recalled and reworked, discarded again, and so on. Most creative thought, 60 to 80 per cent of experimental cases, gives evidence of this sort for the phenomenon of incubation.

*Illumination* is the formulation or organization of the central idea, form, or design on which a poem, picture, experiment, or invention is based. The idea or plan, which has often been incubating for some time, may be accompanied by emotion: "Hurrah! I've got it!" It may come to mind suddenly, in a flash of insight, and mysteriously, as if it had no antecedents, but when the phenomenon of incubation and the suddenness of perceptual reorganization (see page 175) are recalled,

much of the mystery dissolves. Nevertheless, illumination is often a dramatic moment, a favorite of the biographers of great thinkers.

*Revision* is the refining and polishing of the central idea, *i.e.*, putting it into finished form. The thinker's attitude during revision is quite different and certainly less excited than during the earlier phases. He stands back and looks critically at his efforts, recalls his main purpose and his audience, looks at general effects and details. He judges the relative advantages of alternative solutions and may even calculate gains and losses. If the finished product looks good, he is done. Thought ceases. If not, the whole creative process may begin anew, or he may pick out a small part to be adjusted or polished or reworked. Any careful observer, watching an artist, poet, scientist, inventor, or ingenious businessman at work, can differentiate this phase from the others if the thinker will talk about his efforts and disclose his progress to view.

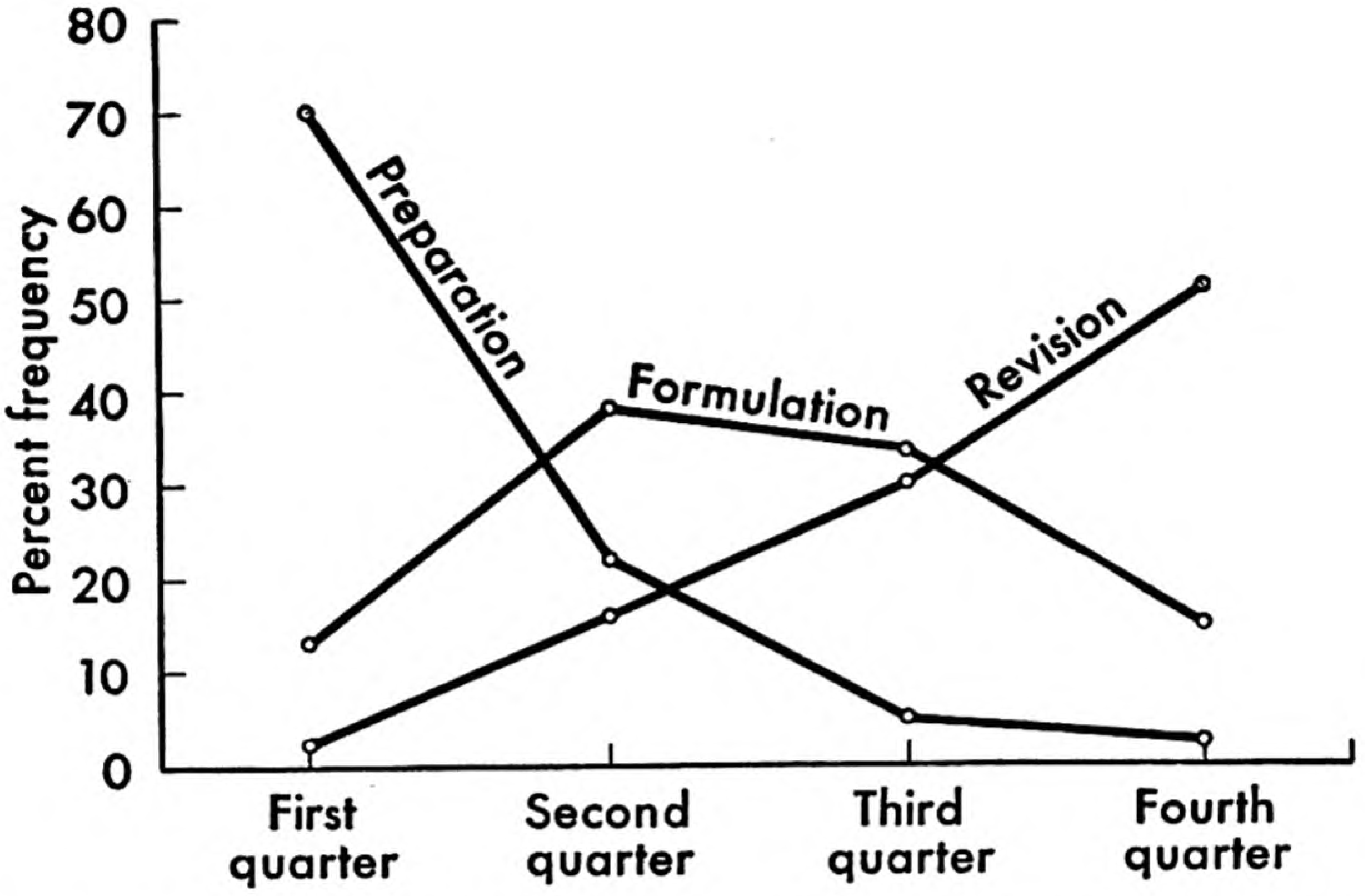


Fig. 86. Phases of thought during four quarters of a creative enterprise. Poets and artists carried on their typical creative practices while a psychologist recorded their activities and timed them. Preparation, indicated by thought changes, is most frequent in the first quarter. Revision is most frequent in the last quarter. Formulation, or illumination, indicated by the first drafting of a line or the first sketching of a general shape, is most common in the second and third quarters. (*Data from Patrick, Creative thought in poets,*[4] *Table 1, and Creative thought in artists,*[4] *Table 1.*)

These four phases of creative thought overlap each other, incubation in particular often running concurrently with the others. Preparation, however, is more frequent in the early part of creative endeavor, revision in the last part, and formulation of the guiding idea

or design (which usually is a result of illumination) occurs most frequently in the middle periods. Figure 86, which was constructed from Patrick's observations of poets and artists, both professional and amateur, shows the frequency of these three kinds of activity during the four quarters of a period of creative effort.

## 3. *JUDGMENT*

Under the general heading of thoughtful or intellectual activity comes the process of judgment or decision. A person is faced with two or more alternatives and must choose among them. "Shall I take apple pie or lemon pie?" "Which is the shortest road home?" "Have I found the correct answer to this algebra problem or must I do it over?" "Which of several ways of ending the poem is most suitable?" "Shall I phone Millicent or Geraldine?" Judgment overlaps reasoning and creative thought, because in the solution of any complicated problem a person usually decides on the ideas, plans, and solutions that he has thought up before he goes ahead and uses or revises them. *Judgment* is not the same as problem solving, however. It is decisive rather than productive. In a court of law the judge's role is not to produce evidence but to decide on the evidence produced by others. Nothing new is elaborated by judgment; it is the process of choosing among alternatives presented by some other process, by direct perception, as in the case of the apple pie and the lemon pie, by memory and anticipation, as in the case of Millicent and Geraldine, or by a previous creative process, as in judging the merit of a poem one has just finished. Trial-and-error problem solving at its highest level consists of the alternate production and judgment of one new idea after another.

When one of the alternatives presented for judgment is decided upon, the thinker's acts and beliefs are usually modified in some way. If Mrs. De Giacomo's soliloquy at the fork of the road leads to a decision, she will go forward on one road rather than the other and will believe that that road runs to Hillsdale. The unhappy college girl of Problem 3, after thinking of many plans of action, may convince herself that she needs new clothes, and then act on that conviction. But acts and beliefs do not always agree. Mr. Stone may decide that Clagbaugh would make a better governor than Claghorn, but do

nothing about it on Election Day. And a person may, under excitement or social pressure, find himself doing something before he has decided what is the best thing to do.

The decisions a person makes today, the beliefs he adopts, may be retained and recalled at a later date, or they may not, depending on all the conditions of retention and recall discussed in the previous chapter.

Looking at the judgment, then, as the end result of a period of thought, our task is to determine some of the factors or independent variables that enter into the formation of the judgment. One way to begin would be to ask people why they reach their decisions to do what they do. "Why did you vote for Clagbaugh?" "Why did you buy a car?" "What facts entered into your decision to quit school?" This is a perfectly straightforward technique, but, unfortunately, it does not work. The discovery was made long ago—and it can now be taken as a general principle of judgment—that a person's decisions are influenced by many facts, experiences, hopes, and fears, some of which he is not even aware of. Most people, for example, will judge girls wearing glasses more intelligent than the same girls without glasses. Yet when they are asked the basis for their judgments, they will be unable to give any reasons, or will give a variety of reasons that have nothing to do with the real deciding factor. Yellow margarine, and yellow butter for that matter, will be given a higher taste rating than the same substance when white. A poem that is attributed to W. Shakespeare will be judged better on the average than the same poem when it is attributed to J. Blough.

This principle, which no sensible person would question even if the psychologists had not proved it, raises serious difficulties for market research and public-opinion polls, as well as for the psychology of judgment. If people do not know the facts on which they base their conclusions, how can anyone else hope to know? For an answer to this teaser let us look at an experiment performed recently by G. R. Thornton, of Purdue University.[6]

Thornton took photographs of some girls with glasses and others without glasses, showed them to a group of college students, and asked them to rate the girls for intelligence, dependability, honesty, and industriousness, among other things. The girls with glasses were rated higher on these four

traits than those without. Then, just to be sure that it was the glasses and not the girls which made the difference, he reversed the procedure. The girls who had posed without glasses now posed with glasses, and those who had posed with glasses now posed without them. Thornton then showed these photographs to a new group of judges and got the same results. The photographs with glasses were rated higher on these four desirable traits, though the same girls had been rated lower by the other judges when they were not wearing glasses. Thornton compared smiling girls with sober-faced girls by the same procedure, and it turned out that the smiling girls were judged to be more honest. It seems like a lot of trouble to find the answer to a simple question, but there is no easier way to do it.

This little experiment, though it deals with a relatively unimportant problem, may be taken as typical of the procedures psychologists have to go through in order to uncover the factors that lead to a simple judgment. Psychologists may ask people why and how they reached their conclusions, but the answers are accepted only as hints for research, not as scientific evidence. Scientific principles of thought and judgment come from experimental arrangements whereby people are given different sets of facts to begin with, or they work under different motivations, or with different prejudices; then the influence of these independent variables can later be seen in the results of thought, in the dependent variables such as the conclusions reached, time required, and changes in subsequent behavior or in announced beliefs. Since judgments, or opinions as they are often called, of the public at large on controversial political and economic issues are particularly important for social psychology and practical politics, Chap. 9 will discuss what recent research has disclosed about the factors entering into public opinion.

Essentially the psychology of judgment is a matter of organization. It is true that the many factors that influence the decision may be pondered and weighed against one another separately, as when a child, forced to choose between a chocolate bar and an ice-cream cone, rehearses alternately the anticipated delights of each, or when a voter decides between two candidates for public office by listing their advantages and disadvantages. If there is no preponderance of appeal pushing the decision to the one side or the other, the decision finally reached may be relatively arbitrary, depending on the balance of

power at the moment when the decision is forced, either by the exhaustion of the storekeeper's patience or by the voter's entrance into the booth. But such a mechanical balancing of good and bad is much less common than one might suppose, in spite of the recommendations of the judicious Poor Richard. In the same way that the nerve cells of the eye predispose human beings toward the perception of patterns of environmental stimuli, so the connections between nerve cells in the brain predispose us toward combining memories, facts, yearnings, and all other ideas going through the head, into thought patterns. Because the isolationist philosophy is contrary to the anatomy and physiology of the nervous system, it is not only the facts themselves, but how the thinker organizes them that makes the difference in the conclusions of thought.

The patterns into which ideas are organized for judgment are many and varied. One of the simplest patterns is a mere association. Mr. A may be judged "rich" if he is remembered as being often in the company of rich Mr. B. A cigarette may be judged "smooth" if it is pictured in the hands of smooth men and women riding in smooth automobiles. This is a relatively thoughtless sort of judgment, like that of Mrs. De Giacomo's child, who feared the cat after it was associated with a loud noise.

Judgment, like perception, operates within a figure-and-ground pattern (see page 105), the background in this case being called a *frame of reference* or context. The object of thought is seen within this frame of reference and judged accordingly. A line will be judged "long" or "short" in relation to other lines in the perceptual field, or perhaps in memory. It is important to note that the background pattern or context may be taken for granted and ignored, while the objects, facts, or ideas in the foreground stand out clearly in attention and in memory—even though the context is equally necessary for the judgment. In a court of law, the judge or jury may deliberately and consciously take the background of the accused's activities into account in reaching a decision, but when the judge tells the prosecuting attorney, "This is an excellent cigar," he is unconsciously placing this cigar against a background of many other cigars, good and bad. It is just because the background or frame of reference is not always debated so criti-

cally as the facts in the foreground that the prosecuting attorney and the defense attorney, each in his turn, tries to set the case within a frame of reference that will make judgment for his side "self-evident."

Of all the ways of putting the facts and figures together to make a judgment, a person naturally tends to use those that he has used in the past. If he has recently been studying logic, he may attempt to organize the data into familiar patterns of logical relations, like the syllogism, so that the conclusion can be easily evaluated. Or he may use a method which his father, his teacher, or his favorite radio commentator uses. Frames of reference are acquired in some cases by generalization, just as concepts are acquired.

## EFFECTIVE THINKING

Certainly problems that require the mastery of abstract concepts, like "world organization" and "hemolysis," are going to be difficult, whether reasoning or creative imagination is called for. It is so much easier to think about paper clips and leaky roofs. Problems are difficult, also, when they deal with a large number of facts or ideas, when there are many parts to be kept in mind and assembled in suitable order. Consider the interesting question: Are brunets friendlier than blonds? It is a hard one because there are so many brunets and blonds, who are tall, friendly, talented, and diabetic, among other things. The number of cases exceeds the attention span, but one can get a rough answer to this important question—though people seldom go to such lengths—merely by counting the number of friendly brunets and friendly blonds that one knows. In Problem 7, on page 197, about the ages of a man and his wife, the relations are abstract and are confused with one another, so that the solution is doubly difficult. The usual technique for handling this confusion is to get the facts and relations expressed in symbols of some sort, so that they can be put down in a diagram, like the diagrams of the syllogisms, or written in mathematical form. The great power of mathematics is that, once the data of the problem are put into algebraic language, the relations between them are much more easily manipulated. Whatever technique is used, when the problem is a complicated one, it must be broken down and handled in parts, without losing one's

orientation to the whole. Research organizations and individual thinkers are alike in this respect.

All genuine problems are difficult, in some degree. The precise word, the appropriate plan of action, the clarifying insight—none of these comes to mind at once, but must be dug up from the depths of memory, picked out of the visible surroundings, or created anew from many unrelated sources. If the idea required is a semifamiliar one, only a half inch back from the tip of the tongue, it will come quickly and many people will get it correctly, so the problem will be called only moderately difficult. It is when the idea required is embedded in some other pattern and has to be wrested from existing entanglements that solution is particularly baffling.

Goldilocks and her two dogs (Problem 6) illustrate this principle neatly. The reason it is hard to find the outlines of the hidden figures is that these outlines make good sense as they are first seen, as parts of the patterns of trees, leaves, and ridges. It is necessary to break down existing patterns and reorganize the details into new patterns that meet the requirements of the present problem. Such a problem is much easier when the existing pattern is so obviously defective that it forces a reorganization, as in the prize pun cited by Max Eastman in his *Enjoyment of Laughter:* "You can't teach an old gnu tricks." In laboratory experiments on the use of tools, psychologists apply this principle to make their problems as easy or as hard as they wish. If the problem can only be solved by the use of a 2-inch stick as a support, for example, leaving a suitable stick in plain sight makes the task very easy. If, instead of a stick, a piece of chalk is left in view, the task is somewhat harder, for the chalk is seen as part of another pattern, one made up of blackboards, erasers, and writing, which is meaningless for present purposes. When the stick appears as part of the ornamentation of the table, very few people will be able to disentangle it from the table pattern and grasp its functional value as a tool.

Difficulty arises not only from a problem itself but from a sequence of problems, for that creature of habit called man can quickly get himself into such a rut that even easy problems become hard. Anyone who wishes to prove this point for himself is invited to consider 11 problems put together by A. S. Luchins[7] of the New School of Social Research in New York, and work each one in order. Hints are given for the first two.

| *Problem* | *Given an unlimited amount of water and the following empty jars as measures* | | | *Measure these amounts* |
|---|---|---|---|---|
| A | 29 | 3 | | 20 |
| | (Obviously one fills the big jar and pours enough from it to fill the small jar three times.) | | | |
| B | 21 | 127 | 3 | 100 |
| | (One fills the 127-qt. jar and from it fills the 21-qt. jar once and the 3-qt. jar twice. Exactly 100 qt. remain.) | | | |
| C | 14 | 163 | 25 | 99 |
| D | 18 | 43 | 10 | 5 |
| E | 9 | 42 | 6 | 21 |
| F | 20 | 59 | 4 | 31 |
| G | 23 | 49 | 3 | 20 |
| H | 15 | 39 | 3 | 18 |
| I | 28 | 76 | 3 | 25 |
| J | 18 | 48 | 4 | 22 |
| K | 14 | 36 | 8 | 6 |

What usually happens is that the thinker becomes accustomed to a method, or acquires a *direction habit,* which works quite well down to Problem H, but strikes a snag on Problem I. Some people never do solve I, though it is absurdly easy to those who have not had the benefit of previous practice. Even G and H can be solved by an easy method, but most people do them the hard way.

***Suggestions for improvement.*** Are there no tricks for beating this game? No ways of jostling the nervous system to break the hold of conventional patterns and stereotyped reactions? What will make productive thought flexible and imaginative in its pursuit of the solutions to life's problems? At this point we must be specific. For the problems, as well as the chemicals of this world, there are no universal solvents. The tricks of the trade, the common errors and false assumptions, the backgrounds of knowledge and skill, are peculiar to each different line of endeavor, and each must be mastered separately. Everyone has

heard those stories about the brilliant physicist falling back to schoolboy fallacies when he talked about God, and the highly imaginative poet whose ideas on economics were strictly nineteenth-century. Nevertheless, it is possible to describe three conditions of productive thought, all more or less amenable to self-control, which promote fluency and flexibility of imagination. The evidence is scanty, but the matter is tremendously important, so these three pointers shall be dignified by names: the spirit of the game, the technique of alternation, and the value of being explicit.

Certainly ideas and insights do not flow out of nowhere. They flow from a well of observation and experience. But when the ideas in reserve do not flow readily, when the well is hard to tap, the critical factor may be an attitude or personality trait, *the spirit of the game.* The production of new ideas, or the reorganization of the old ideas into a new pattern, requires a willingness to take the chance of letting a new illumination disturb the existing congenial and well-founded patterns. This aspect of the creative spirit has never been expressed more precisely than by John Dewey.

> Let us admit the case of the conservative: if we once start thinking no one can guarantee where we shall come out, except that many objects, ends and institutions are doomed. Every thinker puts some portion of an apparently stable world in peril and no one can wholly predict what will emerge in its place.[8]

A certain minimum of personal security seems to be necessary before a person can adopt the reckless attitude required for such a hazardous undertaking. A tightrope is no place for spontaneity. That is why, when children are experimentally frustrated before taking an intelligence test, the frustration has its greatest effect on just those questions which require the fluent production of ideas.[9]

The risk the thinker runs, however, may be only temporary and partial. Most thinkers unconsciously adopt an *alternation technique,* shuttling back and forth between rigid logical reasoning about the ideas at hand and the flexible play of imagination, which produces new ideas. These new ideas are then returned to the cold scrutiny of critical judgment, which evaluates and revises the contribution, consolidating gains, and launching the play of imagination off again from an advanced position. But it is better to alternate deliberately and whole-

heartedly, rather than unconsciously, for both the right wing of critical thought and the left wing of revolutionary fantasy are necessary; the golden mean is dross.

Thought experiments coming out of the psychological laboratories for many years have demonstrated that the baffled thinker may be helped at one time with one problem by a reminder of logical necessities, and at another time with another problem by encouragement to loosen up and dream more freely. And research scientists report that they actually do follow an alternation procedure, loading up with all the available facts and their implications, then dropping the matter temporarily or going for a walk, to let the facts play amongst themselves, unrestrained by interference with conventional patterns and fruitless approaches.[10]

The *value of being explicit* hardly needs emphasis. For several centuries, logicians have been advising thinkers to define their terms, to have their facts firmly in mind, the relations between the facts and their frames of reference precisely stated. Going a step further, we can recommend that thinkers be explicit not only about their terms, facts, and concepts, but about their activities also. Whether one begins a problem with a preliminary survey of the facts, an analysis of the sources of difficulty, the production of original ideas, or a tentative line of action, he should plan his procedure and make it quite clear to himself just what he is doing, and what he is not doing, and how each of his activities contributes to the solution of the problem as a whole. Otherwise, it is very easy to abandon one good hypothesis for another before the first one is honestly tried out, or to work along one line and neglect others equally promising. This recommendation is nothing more than the application to individual thought of the practice of research organizations, which systematically break up a problem and assign different phases to different groups of researchers with explicitly described functions: over-all direction, assembling known data, producing likely hypotheses, testing hypotheses, and editing final reports.

**Common errors to avoid.** In recent years psychologists have turned up a curious human tendency, which is responsible for many of the common errors of judgment. It is the tendency to combine some facts and observations into a *general impression* and ignore the remainder. Such a procedure is very common when personality traits are being

estimated. Some prominent characteristics of the individual, his intelligence or his energy perhaps, set up a generally favorable or unfavorable impression, and the other characteristics, if they are noticed at all, are made to fit the general impression. Since this tendency is at fault so often in the judging of character, a special name, the "halo effect," has been given to it, and it will receive the attention it deserves in Chap. 11.

Usually the general impression and the detailed facts lead to the same conclusion, in which case the influence of the two cannot be disentangled. For an ingenious way of separating these two influences Woodworth and Sells[11] turned to the syllogism. Is the conclusion of this syllogism logical, or not?

If no $x$'s are $y$'s,
And no $y$'s are $z$'s;
Then no $x$'s are $z$'s.

The general impression from the "noes" of the first two statements is a negative one, and the conclusion is also negative, so an astonishing number of people will say that the conclusion is correct, although careful attention to the details will later convince these people that no conclusion whatever is logically possible. Woodworth and Sells tried out a large number of such syllogisms and found that a goodly percentage of the errors were due to the strength of the general impression or "atmosphere," and could, in fact, be predicted in advance from knowledge of "atmospheric" principles.

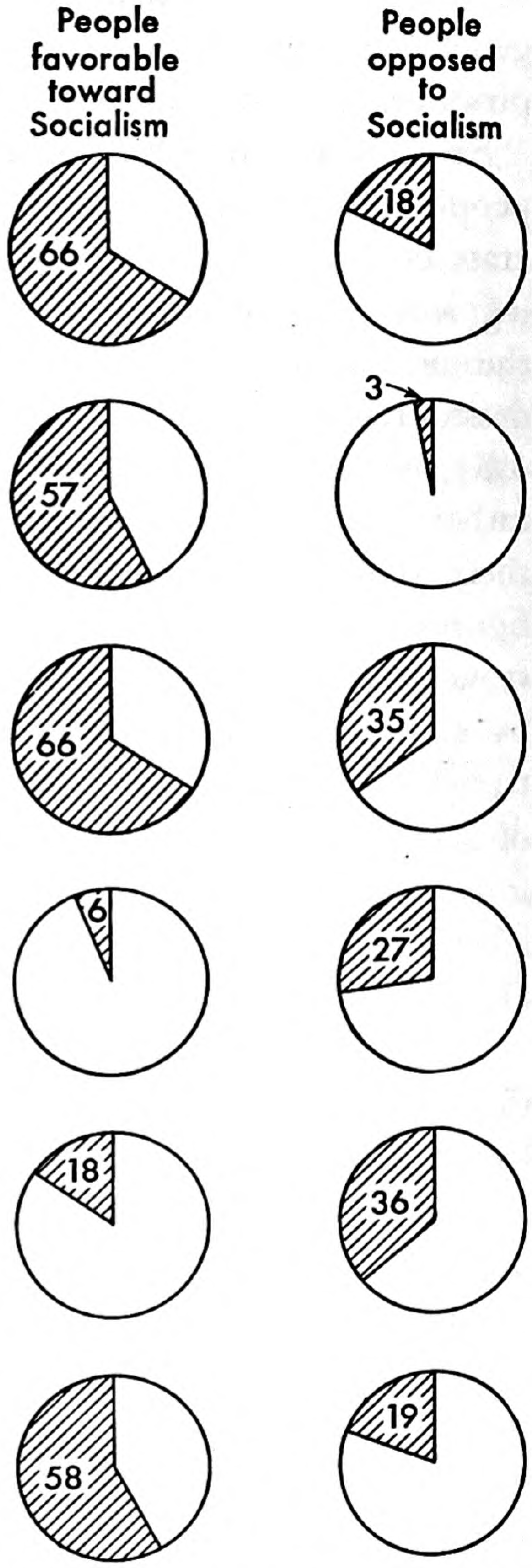
The influence of the general impression can be seen, not only in the judgment of personalities and syllogisms, but also, of all places, in the construction of sentences, where a general plural impression or atmosphere surrounding the subject of the sentence may lead to the use of a plural verb which ought to be singular, or vice versa. Here are two grammatical errors of this sort, the first admitted by Professor Woodworth himself, whereas the second comes from another prominent psychologist.

> Research on intelligence and motivation, on heredity and environment, are gradually clarifying what have always been matters of conflicting opinion.
>
> One of the important tasks which confronts the worker with tests is the construction of scales. . . .

Lest the general impression be maligned unduly, it is necessary to remember that in many judgments, notably artistic judgments, the general impression is what counts, and pedantic attention to details produces absurd decisions.

Since it has become fashionable to point out the biases in other people's judgments, the term *wishful thinking* has been seen in literate company almost as often as "conditioned reflex." Wishful thinking is a popular rather than a scientific term, which seems to mean the acceptance of conclusions or beliefs on the basis of wishes and desires rather than realities. It is analogous to autistic thinking (see page 195), which refers to the direction of thoughts by wishes and desires rather than by efforts to solve a problem. Regardless of terminology, there is no question about the facts. There are plenty of facts and figures, from laboratory experiments and public-opinion polls on controversial issues, to support the generalization that desire and belief do, by and large, tend to agree. At a very simple level the point is illustrated by a youngster working an arithmetic problem based on long division who, because he dislikes long division, manages to interpret it as a problem in multiplication. At a more mature, or at least older, level is the common phenomenon of Democrats overestimating the Democrat vote and Republicans the opposite.

The best evidence for this very human tendency toward wishful thinking comes from an opinion survey carried out in April, 1937, by Hadley Cantril,[12] of the Office of Public Opinion Research at Princeton University. He asked a large number of people in many occupations, bankers, lawyers, editors, ministers, economists, and sociologists, and 35 members of the Communist party as well, to look into the future and predict the outcome of certain economic and political trends. At the end of the questionnaire he unobtrusively inserted a few questions about attitude toward socialism, labor unions, and political parties so that he could compare these people's predictions of events with their hopes. The comparison turned out as one would expect. When the question was asked: "Do you think the United States government will sometime own and operate all radio broadcasting?" a large fraction of those who were in favor of socialistic changes predicted that the government would do so, while only a small fraction of those opposed to socialism made this prediction. Figure 87 gives the



Percentage who "think the United States government will sometime own and operate all radio broadcasting."

Percentage who "think the United States will ever be a collectivized state, comparable to the pattern of Soviet Russia."

Percentage who "believe that a strong national Farm-Labor party will be formed as a separate party organization by 1944."

"Which side do you think will win the Spanish Revolution?" Percentage who reply "Rebels."

"How long do you think the present form of government in Soviet Russia will survive?" Percentage who reply "less than 20 years."

"How long do you think the British Empire will survive in its present form with its present possessions?" Percentage who reply "less than 20 years."

Fig. 87. Evidence for wishful thinking from a 1937 public-opinion poll. Sixty-six per cent of the people who were favorable toward socialism thought "the United States government will sometime own and operate all radio broadcasting." Only 18 per cent of those who were opposed to socialism thought so. (*Data from H. Cantril.*[12])

percentages for a few of Cantril's questions. Of the 12 occupational groups, the life-insurance executives expected the fewest changes and the Communists the most, and it was in these groups of extremists that the correspondence between expectation and attitude was highest.

Along with the effects of desires on beliefs go the effects of *suggestion.* The general principle is that people tend to accept the statements of those whom they respect as experts, waiving in part their customary critical judgment. Advertisers pushing sales and propagandists pushing ideas make good use of this principle by having their merchandise endorsed by those who have a position of prestige in the public eye. Much of the psychology of social relations, outlined in Chap. 9, depends on this principle.

In the settlement of one's own personal problems, the chief distorting factor that should be listed is the effect of *repression.* Since attention is largely under the control of motives and emotions, as Chap. 5 pointed out, it is very easy for the thinker to ignore the unpleasant or logically awkward thoughts that come to mind. The facts of life are often hard to face. Since motivation affects recall also, as Chap. 7 made clear, those recollections which suggest a disagreeable course of action or are associated with unpleasant consequences in the past may simply not come to mind at all, that is, they may be repressed.

It is possible to overemphasize the importance of these insidious hazards of thought and judgment. In Cantril's 1937 survey, for example, 80 per cent of the people questioned expected a general European war, although the number who desired such an outcome must certainly have been small. The facts, whether interpreted rightly or wrongly, do have a say in the decision, and when the facts are clear-cut, one way or the other, they may outweigh hopes and fears to the contrary. No one enjoys the decision to visit a dentist but, if people can feel the facts sharply enough, they will face them.

The best way to understand this business of thinking, including the wishful, critical, and garden varieties, is to remember that the outcome of thought, like the outcome of any other human enterprise, depends upon many factors, upon observations, impressions—whether general or specific—facts and inferences therefrom—whether logical or not—motives, emotions, and a variety of social influences. Naturally the thinker's inner motives may not be those that he talks about, and the

motives behind the final judgment may not be those that started the train of thought on its zigzag course. In thinking about the problem of unemployment, for example, one may begin squarely enough, then shift his aim toward a conclusion that will show what is wrong with labor unions, or with industrial capitalism. When the blame and the credit for the outcome of thought are handed out, it is necessarily true that the stronger the emotional provocations, the less powerful becomes the influence of pure reason, and, in reverse, the more compelling the structure of the facts and their organization, the less they can be budged by emotion.

Does all this mean that the best thinking is carried on in the chilly atmosphere of unemotional disinterest? The modern answer to this old question is an extension of an ancient maxim: Compose with fury and correct with phlegm. When fanned by the breath of emotional excitement, from whatever source, the fires of productive thought do burn more furiously and persistently, and the light may reach out into regions previously left dark by calm neglect. It is the decisive phase of thought, the final revision of those enthusiastically conceived ideas, which profits best by frigid dispassionate calculation. In the last critical judgment, before putting the plan into action, before signing on the dotted line, or before making the fatal proposal, it is wise for everyone to clarify his own motivation and, if possible, the motives of those whose counsel has influenced his thinking. Psychological experiments have demonstrated that intelligent adults do recognize, and guard themselves against, the obvious biases of informants, commentators, and other agencies of communication and, furthermore, that training in critical thinking raises the guard a notch higher.[13] After all this is done, the troubled seeker after truth must still remember that no psychological analysis of a chain of argument can substitute for the tedious business of collecting facts and figures or the painstaking examination of their logical consistency.

***Effect of drugs and physical conditions.*** Anything that seriously interferes with the efficient functioning of the body, such as extreme fatigue, extreme emotion (see page 37), alcohol, or oxygen shortage, is likely to interfere with efficient intellectual performance. Caffeine in moderate amounts improves most psychological functions. The case of alcohol has aroused considerable interest, especially in connection

with the popular belief that the drug affects the higher mental processes first, when small amounts are drunk, then, as demon rum extends the grip of his evil tentacles, even the lower physical faculties are weakened. The evidence does not support this belief; it could just as well be reversed. The simple reflexes, muscular coordination, and steadiness are quickly affected, approximately as indicated in Fig. 88—though one must remember that individuals differ widely in susceptibility—but when experimenters have tested the influence of alcohol on thought and judgment, they have been surprised at the outcome. Attention span and the ability to read and to concentrate are usually reduced, and distractibility is usually increased, but in one careful experiment the ability to draw logical conclusions from syllogisms was scarcely affected at all.[14] Some well-known writers have claimed that their flow of ideas is improved by alcohol, as well as opium and other intoxicants, and, though the claim has never been scientifically proved, it is at least possible that release of inhibition, which some drugs bring on, could improve the quantity if not the quality of productive thought.

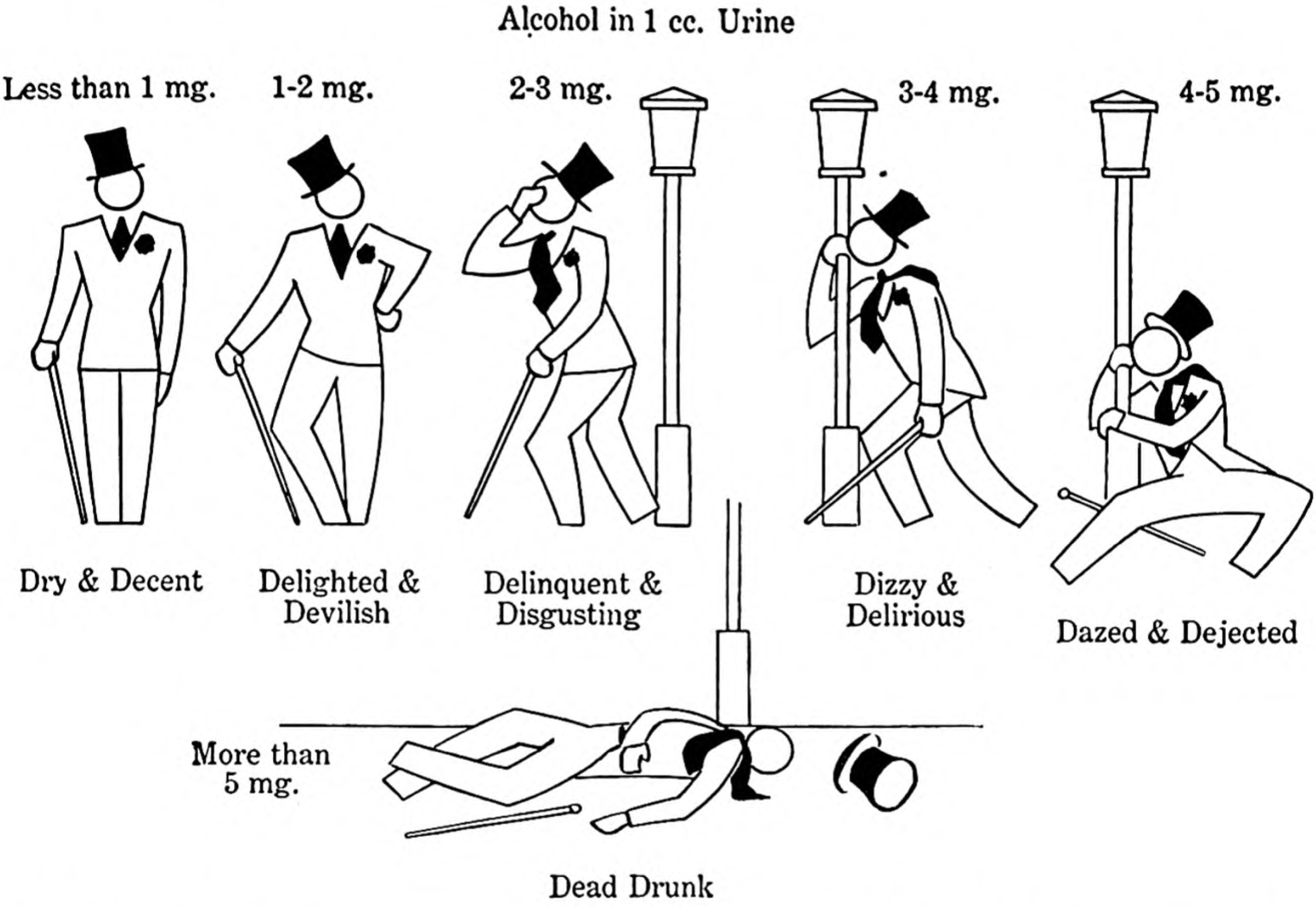


Fig. 88. Relation between amount of alcohol in the urine and degree of intoxication. These figures are averages; people differ greatly in susceptibility to this drug. (*From Alcohol and man, Macmillan, 1932. By permission of H. Emerson.*)

### INDIVIDUAL DIFFERENCES—WHY SOME PEOPLE THINK BETTER THAN OTHERS

Inspirational psychologists, of radio and digest fame, like to tell anecdotes about great thinkers, for the same reason that picture magazines will give more space to a pretty girl than to a homely one. But the bodies of both girls will look alike when they reach the dissecting room, and the anatomy of Einstein's thought is about the same as David Stone's. There are stories about some famous intellectual giants at the end of Chap. 10, but the intellectual gain from *reading about* John Stuart Mill (IQ about 180) is no larger than the muscular gain from *looking at* pictures of Bernarr MacFadden's biceps.

Of all the reasons why one person may think better than another, the most important is the *knowledge* he has to think with, his background of experience, his familiarity with the common mistakes. If the problem is whom to vote for, the man who knows most about the candidates and the office will make the best decision, other things being equal. If the task is writing a poem, a good vocabulary and some familiarity with the successes and failures of other poets are valuable assets. This is an obvious point, but it is easy to overlook in favor of some mysterious knack to good thinking.

Certainly all-round *intelligence* is always an asset to good thinking. The definition of general intelligence begins, in fact, as the ability to solve the general run of life's problems, then is narrowed down by statistical considerations, which will be explained in the proper place. The feeble-minded are sterile of ideas, they show poor judgment, and they are notoriously suggestible. "Idea men" must be at home with abstract concepts, able to handle subtle relationships between subtle ideas, whether they spend their time in science, art, business, or politics.

Next in order would come the capacity, and the willingness, to attend persistently but selectively to the problem as a whole and to its many parts. This concentration or *control of attention* is tested to some extent by most intelligence tests, but it is a particularly crucial matter when the problem at hand is a complicated one requiring frequent shifts from fluent productive thought to rigid critical judgment, and back again. Rigid minds will perseverate along one fruitless line of attack. Scatterbrains will not exhaust the possibilities of even the first

good lead, will not exclude irrelevant data, nor check upon the adequacy of their conclusions.

*Fluency of imagination*, the ability to dream up new ideas, which is not the same as knowledge or persistence or intelligence, though it ties in with all three, is at the center of good thinking; so psychologists, particularly in England, have endeavored from time to time to find ways of measuring it and locating its origin. They test a person's fluency by getting him to think up words to fit specified requirements, such as five-letter words ending in *l*, or names of animals that are also names of cities, to complete unfinished pictures and stories, and to build designs with sticks. People who are fertile of ideas in one field are likely, with some exceptions, to be fertile in the others.[15]

When we ask where fertility of imagination comes from, the evidence points to environment more strongly than heredity,[16] to something in family and school training that robs some children of their natural spontaneity and inventiveness while leaving others with this gem relatively undisturbed. Because the child starts life with potentialities for a wide range of behavior, it is easier to point to certain characteristics of the growing-up process that narrow the range of fertility than to anything that widens it. Not that children have better imaginations than adults. Children's stories are written and illustrated by adults, and, for the most part, bought and sold by adults. But children enjoy using their imaginations more than their elders, and need no monetary encouragement to do so.

Parents and teachers can inhibit a child's spontaneity by asking him, when he is drawing, "What is it a picture of?" for the child may merely be drawing, not drawing a picture *of* anything. Or, when a child comes home with a highly imaginative story, the majority of parents train him to stick to the facts by saying, "Now you know that isn't true, don't you?" though a few courageous parents will compliment the young Munchausen for his tall tale, encouraging him to improve his narrative technique, and an even smaller number of extremists will try to match the child's whopper with a taller parental accomplishment. With a few exceptions the chief aim of the organized educational agencies in any civilization is to make children do things right, the way the adults in that civilization do things. It is much later, when the child has become an adult and meets difficult adult problems at

home or on the job, that the emphasis swings back to imagination, ingenuity, and inventiveness.

Parents and teachers defend their restrictions of childish spontaneity by pointing to the madman looking out the asylum window and dreaming that he is Napoleon; children must learn the difference between fantasy and reality. There is, of course, no reason to think that exercise of the imagination ever produced insanity or even that insane people of any type are more imaginative than normal people. Nor is it likely that imaginative children have any particular difficulty learning where reality stops and fantasy begins. It is the adult culture which is responsible for the Santa Claus myth and the stork, as well as an inferno of assorted sins and bogeymen, and it is hardly sporting of the adults to blame children for a pallid miniature of their parents' deception.

Those maladjustments which are usually blamed on imagination, such as girls' deliberately trying to shock adults and boys' dreaming of success while doing nothing to reach it, are problems of motivation and social relations more than of imagination, and should be treated, not by putting a taboo on imaginative enterprise, but by getting at the real difficulty. When these minor difficulties are straightened out, so that the youngster feels more secure in his social relations, imagination often blossoms anew. That, in general, is the parents' and teachers' task: to socialize the child, teaching him the best of the adult culture without, in doing so, robbing him of his natural heritage of childish creativeness.

## SUMMARY: PRINCIPLES OF THOUGHT

When "thought" means what we think about, *i.e.*, the ideas that go through our minds, the principles of thought are the principles of attention. Our thoughts are touched off by striking stimuli in the present situation and by strong associations with the past, spurred on by a variety of motivating conditions. These thoughts are subjective phenomena, perceived only by the thinker himself, but often quite vividly communicated to others.

Thinking directed by one motive or another toward the solution of a problem can be investigated by observing the thinker's actions, reports of his thoughts, and comments on his progress toward the solution, then checking these against more objective evidence on solutions reached, errors, and time. The production of ideas to fit the problem

requirements is rapid at first, but slows down as the reserve of ideas is depleted. As promising ideas are produced, they are checked against the requirements of the problem; this alternating elaboration of ideas and their critical evaluation is what gives thought its trial-and-error character.

When by "thoughts" we mean opinions, beliefs, and judgments, we are referring to the ends or conclusions of a thoughtful episode. Judgment or evaluation of the ideas, thoughts, or solutions produced by creative imagination and reasoning usually takes place within a frame of reference, which may include the requirements of the original problem.

Problems are likely to be difficult when they deal with abstract concepts, when they are complicated, when the correct solution is embedded in another pattern, and when they encourage the learning of wayward direction habits.

The difficulties of thinking can often be overcome by getting into the proper spirit of the game, by alternating between the flexible play of imagination and rigid criticism of the outcome, and by being explicit about both the materials and the processes of thought.

Common errors to be avoided are judgment on the basis of a general impression only, wishful thinking, uncritical acceptance of the suggestions of others, and repression of the more disagreeable facts of the case.

The principal factors that explain why some people think better than others are knowledge, intelligence, control of attention, and fluency of imagination.

## TECHNICAL TERMS FOR SPECIAL STUDY

content of consciousness
problem solving
free play of thought
autistic thinking
reproductive imagination
productive imagination
rationalization
reasoning
syllogism
creative thought
preparation
incubation
illumination
revision
judgment
figure and ground
frame of reference
direction habit

spirit of the [illegible]

alternation [illegible]

due of being [illegible]

[illegible] control

wishful thinking [illegible]

suggestion

# 9

# THE INDIVIDUAL AND SOCIETY

Social psychologists like to emphasize the truism that no one lives in a vacuum. Everybody is born, lives, and dies in a specific place and time. He grows into and becomes a part of a specific social organization, a society. It is necessary and profitable to study psychological processes, like learning and thinking, in the abstract, but it is necessary also to remember that what people learn and think about is conditioned by the social situation in which they operate, the problems society offers them to chew on. If we could take two little girl twins of identical heredity and separate them shortly after birth, sending one to develop in New England and the other in New Guinea, and then come along 30 years later with our modern techniques of psychological tests and clinical observation, we would see a very instructive set of similarities and differences. The two girls would be very similar in height, facial structure, skin color, eye color, hair color, amount of hair on the upper lip, blood type, and susceptibility to certain diseases. In these traits, and probably some others that we are not yet sure of, the girls would resemble each other more than two twins, not identical, who grow up in the same family in the same culture. But the resemblance ends quickly. They would wear different clothes, do their faces and their hair according to different styles, worship different gods, worry over different problems, like different foods, become angry at different offenses, and strive for different goals. In these social traits, two girls of quite different heredity, who happened to grow up in the same time and place, might be more alike than our originally identical twins.

This chapter is concerned with social development. Height, facial structure, hair color, and many similar characteristics are hereditary. Their development takes place by maturation (see page 136) of inborn potentialities. Social development, on the other hand, is part of the

learning process. Social habits, attitudes, and personality traits are acquired through social interaction (see page 150) and depend upon motivation, practice, and examples for imitation and identification. This chapter, then, is an extension of the chapter on learning.

Social development is not the haphazard, highly individual process one might expect it to be. Children are very flexible. They could, for example, learn many, many different ways of greeting people. But actually they learn only a few, usually only those ways that are customary in the social organization in which they live. The general principle of social development, which may be called the *socialization principle*, can be stated at the outset: Social development proceeds from the simple, undifferentiated, and pliable behavior patterns of the child toward the complex, specific, and relatively permanent customs and attitudes of the adult culture. By *culture* we mean the way of life, the pattern of habits, customs, attitudes, and beliefs common to the people living in a society—all of which, of course, are learned, either intentionally or incidentally.

## THE STRUCTURE OF MODERN SOCIETIES, ESPECIALLY OURS

In contrast to the course of maturation, which is determined chiefly by the germ cells that the individual grows *out of*, the course of social development is determined chiefly by the society that the individual grows *into*. It would be very difficult for anyone to understand the development of a socialized human being if he did not know what adult society is like, for the same reason that it would be difficult to understand the construction of an airplane propeller if one did not know about the engine to which it is to be fastened and the function of the whole assembly in flight. It is therefore necessary to describe some of the important characteristics of modern societies, especially those which have a major influence on the social development of the individuals who live in them. Most people have always lived in societies, just as they have always written subjects and predicates, but the structure of society, like the structure of a sentence, is better understood when one takes time to examine it attentively.

**Variations in customs and attitudes.** Anyone who looks at the pictures in the travel magazines or listens to the tales of servicemen who have been stationed in Burma or the Solomon Islands is aware of the

diversity of social behavior throughout the world. In some countries women are not seen by men unless heavily veiled; in other places they wear less than an ounce of clothing. In our civilization marriage is permitted between any but close relatives, but among the Zuni Indians and many African peoples the horror of incest is attached to relations between men and women of the same tribe. The special attitude of the Japanese toward suicide is now well known. Extreme suspiciousness, which is a mark of mental abnormality in America, is the rule in the Dobu Islands of the South Pacific, where, because of the danger from sorcery and witchcraft, the natives do not walk alone, even in broad daylight. Homosexuality is frowned upon in modern America and most of Europe but accepted by some American Indian and oriental cultures.[1] Conduct that an American or European psychiatrist would diagnose as catatonic stupor is similar to a mystical technique used by many Buddhist priests for approaching nirvana.[2] It would be hard to think of any kind of behavior which is not practiced routinely in some sector of this revolving globe.

**Human relations and social groups.** In spite of this colorful diversity of human nature, careful analysis has disclosed many regularities and uncovered some of the common denominators of social relations. All human relations, to begin with, take place within a social structure of some sort. People do not bump against each other at random like marbles in a boy's side pocket; even in the simplest of primitive societies they are organized in social groups of many kinds. The first and *primary group* in all cultures is the family, and living in a family with all the consequences thereof is just as much a part of human nature as the sex impulse. A neighbor group and a small school class may be primary groups. Outside these groups people are organized in *secondary groups* on the basis of sex, age, locality of residence, and common interests of a religious and recreational nature. Furthermore, since all societies, whether agricultural, nomadic, or industrial, exhibit a division of labor, there will always be *occupational groups,* in which the members spend a large share of their time in rather close contact with others doing the same work. A person feels more or less loyalty to his group, especially when his own group, the in-group, is at odds with some out-group. As he mingles with other members of the group, he picks up the group's values, style of dress, conversational interests, occupational or recreational skills, and information. In literate societies most organized

groups have a magazine or paper of some sort, wherein the organization's official point of view is argued. In a society like ours in which there are so many overlapping clubs, associations, and unions, any one citizen is likely to be a member of many, and his loyalties thereby fractionated, but he will invest his ego more strongly in some than in others, for reasons that will shortly be elucidated.

***Status hierarchies.*** Another common characteristic of all societies, one which imposes a definite shape on the social structure, is the existence and operation of *status hierarchies*. All societies evaluate people, ranking them on scales of one kind or another. If we wish to predict how people will act toward each other, the most important facts to know are their positions in these status hierarchies, for these are the pegs which support prestige, backwardness and forwardness in social interaction, privileges and duties, political allegiances, style of dress, and even, to some extent, choice of mate and size of family. These scales on which people are ranked run in many directions in accordance with the dominant values of the culture. In China and other parts of the Orient, age and wisdom have an importance that practical extroverted Western civilization finds hard to understand. Among the Zuni Indians of Central America, the top man is one who is never heard of, strange as that may seem to us. If anyone were to analyze a variety of societies systematically, he would find that people are graded high and low on the basis of many characteristics: parentage, order of birth, income, occupation, education, achievements in warfare, sports, and arts, state of grace (in a religious sense), magical powers as symbolized by ownership of ceremonial objects and knowledge of sacred formulas and songs, and even physical appearance. In most primitive societies where the social structure is a rigid one of long standing, unchanged as yet by the industrial revolution, status on one scale agrees closely with status on the others. This was true in the feudal structure of medieval Europe where those born into the lowest class had the meanest jobs, the least social privileges, and got the least of what the culture had to offer, while those on top of the pile were on top in nearly all respects. In these social structures class lines are sharply drawn and the concept of social class is a genuine one, of central importance in predicting the social behavior of all. In a young country, like the United States, the social structure is not so rigid. Status in the military

may not be the same as status in civilian life, income level may or may not coincide with social status, and the rank assigned to a person by reason of his occupation may be higher or lower than his rank when the day's work is done. This matter of social status is not an academic one; the struggle to rise in social status is one of the strongest manifestations of the self-assertion motive (see page 49). If we wish to make sense out of the complicated crosscurrents of social pressures and counterpressures that assault all men and women daily, we must look more closely at status hierarchies in the United States and examine critically the question of social classes. Only then can we understand some of our own most powerful strivings, the determinants of our loyalties, prejudices, voting habits, and anxieties. Only then can we appreciate what the nation's children are getting into.

## STATUS IN THE UNITED STATES

Status in the United States and other similar cultures is a brew of many ingredients, as we all know, but the principal ones are income, occupation, and parentage.

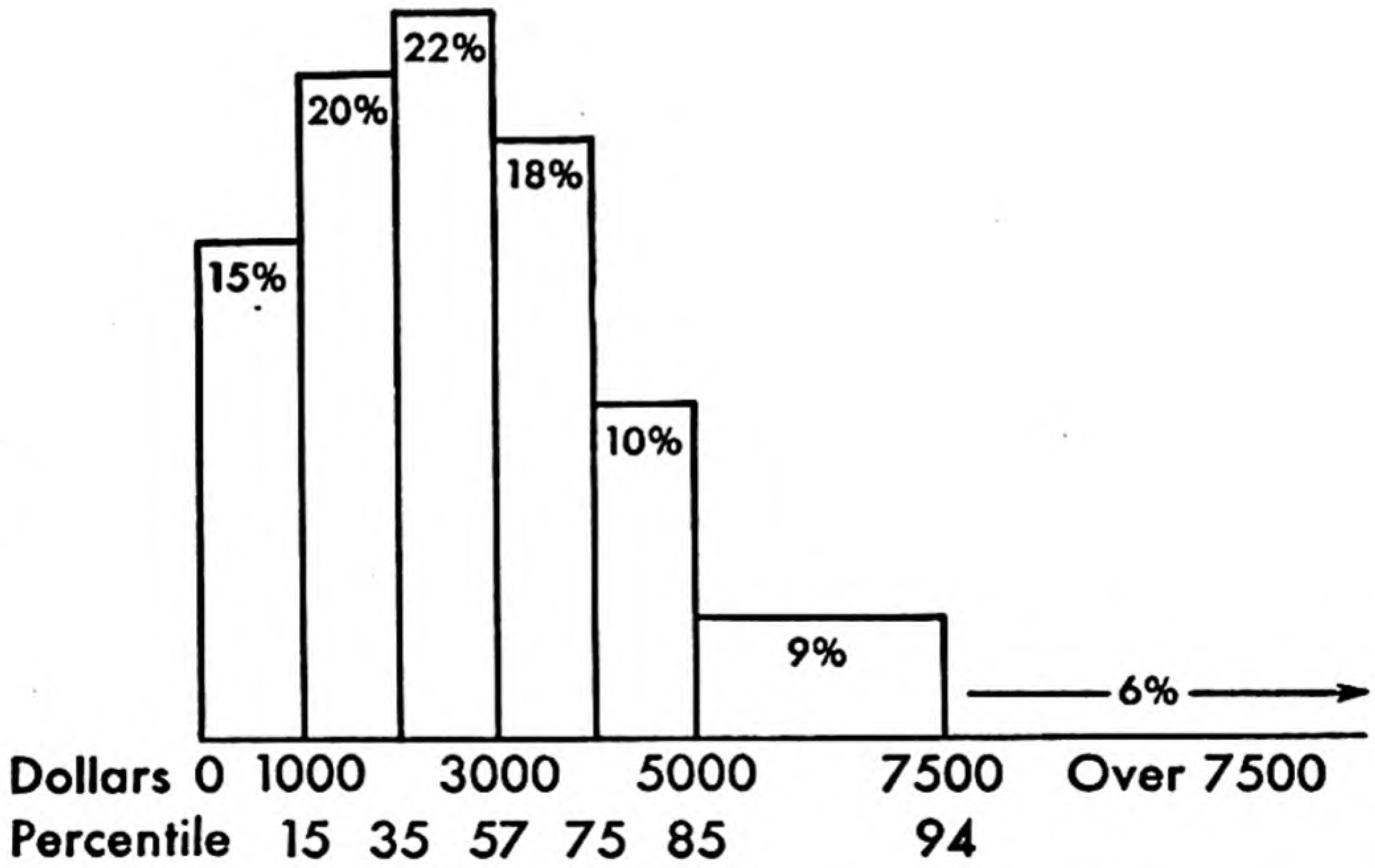


Fig. 89. Family incomes in the United States in 1946. The median income was $2,600. (*Data from Fed. Res. Bull., July, 1947.*)

***Income.*** The distribution of family incomes in 1946 is a skew distribution,[3] as Fig. 89 shows. That is, the bulk of the 40 million families in the United States are concentrated at the low end of the income scale, while a few are in the very high brackets. In fact, the scale would have to be extended to the right several times its present length

in order to include those fantastic salaries of movie stars and steel magnates which the Income Tax Division publishes each year.

There is nothing in these statistics to show where to draw a line marking off the rich from the poor. Nor is there any natural basis for dividing up the nation into three, four, or five income classes. The decrease in number of families as one ascends the economic scale is a gradual one. Some public-opinion polls, in order to show the relation between income and opinions, count the bottom 20 per cent as "poor," the next forty per cent as "lower middle," the next 30 per cent as "upper middle," and the top 10 per cent as "prosperous." All such divisions are arbitrary but, as we shall see later, often quite useful for purposes of analysis. No matter how the distribution is sliced, the percentage of families with small incomes is large, and the percentage of families with large incomes and the status that goes with such incomes is correspondingly small.

But social status is displayed, not only in the amount of money a person has to spend, but also in the way he spends it. All families buy food, but very few buy polo ponies. In general, as income rises, expenditures for nearly everything rise. The necessities come first, of course; it is the amount spent for luxuries, for comforts, and for "conspicuous consumption" that shows the biggest difference between high- and low-income groups. It is these luxury items, in fact, which are the symbols of income status. In 1941, for example, women in families with annual dollar incomes under $500 spent only $1.04 on the average for silk hosiery, while those in families with incomes between $3,000 and $5,000 spent $8.04 for the same purpose.[4] The low-income groups eat more potatoes, beans, and peas while the well to do eat more meat, poultry, and fish.[5] The differences between the expenditures of high- and low-income groups are even more marked in respect to household appliances, recreation, and education. In general we can say that high income brings with it health, prestige, and freedom—freedom of movement from place to place, and freedom from household drudgery.

*Income and attitudes.* Along with these budgetary differences between "have" and "have-not" groups go the intangible but even more significant differences in attitudes and convictions. For many years the upper-income groups—on the average, that is—have consistently been opposed to government regulation of business, government ownership of utilities, to labor unions, and to other attempts at economic reform

or redistribution of income. The effect of money in the pocket on political convictions is epitomized in the attitude toward President Roosevelt and his New Deal. In July, 1938, *Fortune*[6] asked the people this question: "Is your present feeling toward President Roosevelt one of general approval or disapproval?" Of the "prosperous" group 39 per cent gave their approval, of the "upper middle," 53 per cent, of the "lower middle," 62 per cent, and 75 per cent of the "poor." In these respects, *i.e.*, freedom from drudgery and opportunity for education and the other "good things of life," and in attitude on the controversial political and economic issues of the day, the American culture changes noticeably as one goes up or down the income scale.

**Occupation.** "Rich man, poor man, beggarman, thief; doctor, lawyer, merchant, chief." Although there is no hard and fast line between rich men and poor men, the differences between occupational groups, between thieves and beggarmen, between doctors and lawyers, are clear-cut differences of kind, not merely of degree. It is easy for any participant in our culture to rank occupations as to social status. It is one of the first questions a man is asked in the club car, for until a man's occupation is known, his acquaintances feel unsure of him. Just to pin this matter down to objective evidence, psychologists and sociologists have often had a variety of people rank occupations on the scale of status, and the results usually come out the same way, regardless of when the ranking is done or who does it. The professions and business rank high, white-collar workers and skilled workers next, with semi-skilled and unskilled at the bottom. Osgood and Stagner,[7] for example, had Dartmouth college students rate 15 occupations on a scale of prestige with the following results, in descending order of status: surgeon, judge, lawyer, businessman, engineer, musician, bond salesman, foreman, storekeeper, postman, carpenter, tailor, miner, mill worker, and garbage man. These rankings will vary somewhat with the kind of businessman considered, and the kind of tailor, but the general ranking is definite. The status a person has, and his wife and children have also, by virtue of his job, is a prominent characteristic of our society, and of all other societies.

The characteristics of a job that determine its position in the occupational hierarchy are, according to the judgments of these Dartmouth College men, such things as hopefulness of the job, the notice it attracts, the income level, the intellectual and educational requirements,

and the pleasantness and excitement of the job. For these college men factors such as hours of work and idealism had little to do with the prestige of the job. The psychological significance of all this is not the accuracy of these judgments, for any other American group would rate them about the same way, but the fact that a garbage man rightly or wrongly occupies a status different from a surgeon's. One is considered long on brains and short on brawn, while in the other these proportions are reversed. Of course, the people in these occupational categories are not all the same; the garbage man may own a fleet of trucks and the surgeon may be an abortionist, but these prestige values are definite characteristics of these jobs in our society. The men in these jobs take on the color of these status judgments, and their children grow into families in which the status is characteristic of the family.

*Social class and attitude.* In rigidly stratified societies, such as India, there are well-marked *social classes,* the members of which are eligible for different occupations, have different attitudes toward themselves, and expect different treatment from society. Do we have such classes in the United States? How different are the attitudes of the "working class" and the "professional class," for example? Despite the years of talk about class distinctions and class conflict in our society, there has been little dependable evidence on this important problem until recent years. The public-opinion polls occasionally ask people what class they belong to, and the great majority, 80 to 90 per cent, consistently put themselves in the "middle class." For more detailed evidence, A. W. Kornhauser[8] in 1937 surveyed the opinions of the principal occupational groups in Chicago and found large differences in response to questions about redistribution of wealth, government ownership, and labor unions. The differences are typified by the answers to this question about the most discussed political issue of the day: "In general, are you in favor of the New Deal (the policies of President Roosevelt and his advisers)?" Of the major business executives 23 per cent were in favor of the New Deal; of the engineers 34 per cent, minor business executives and small owners 52 per cent, office workers 68 per cent, skilled manual workers 77 per cent, and unskilled and semiskilled manual workers 83 per cent. On the other hand, when the questions were "Do you think that today any young man with thrift, ability, and am-

bition has the opportunity to rise in the world, own his own home, and earn $5,000 or more a year?" and "Do you believe the chances are good that your children will have a higher position and be better off than you are?" the answers in all economic groups were optimistic, with little difference between them. From this research Kornhauser comes to a significant conclusion.[9]

> People at lower income levels, it appears, differ markedly from those better off, in their feelings about the distribution of wealth and influence, the control of economic affairs, and the desirability of changes in a "New Deal" direction. But they cling devotedly to the American belief in individual opportunity. They expect either themselves or their children to "get ahead." Thus important contrasts in clear attitudes on deep-cutting questions of public policy exist side by side with rather general rejection by individuals of any feeling that they are permanent members of a "class."

***Parentage.*** The third of the important factors that influence status in America is parentage. Although in this famous "land of opportunity" we are only a few generations from the frontier where the rifle and the ax made all men equally tall and few questions were asked about family origin, it is not uncommon, especially in the South and New England, that a descendant of a family that is immortalized on battle monuments and the pages of history books has a certain status in society by that fact alone. This factor operates even more powerfully in its negative aspect, in the effects of prejudice against members of minority-group parentage in their struggles to achieve social status. Where the emphasis on parentage is extreme, as in India and some Polynesian tribes, the social structure becomes a caste structure, much more rigid than a social structure based on income and occupation. Technically the North American system is a caste system with two castes, white and Negro, because the primary division is a hereditary one, and the distinction is maintained by a taboo against intermarriage. Within these two castes, however, there are parallel stratifications based on income and occupation. Aside from these negative factors, the direct effect of parentage, in the old-fashioned aristocratic sense, on status in America is a small one. Americans would rather take off their hats to success than to anything else—meaning economic success, of course—and the successful members of the minority groups are not oppressed as much as the unsuccessful. The principal influence exerted by parentage is

an indirect and delayed one, showing up in the endowment of the offspring with advantages or handicaps in the race for success.

These three variables, income, occupation, and parentage, are the dominant features in the stratification of American society and also, because of this fact, the landmarks that fix an individual's position in the status hierarchies of our society. The first two, income and occupation, are closely related economic scales. Those occupations ranked highest are, with a few exceptions, the most profitable, and within one occupational group higher status goes with higher income. The relations between the economic scales and parentage are more complex, since offspring of parents in the upper economic brackets have the advantage both genetically and environmentally (see page 337). They are healthier and more intelligent on the average, less likely to become delinquent, and will be given a better start in the form of education and job opportunities. Thus the factor of family background bulks large in American society, even though it operates indirectly.

The purpose of this sketchy anatomy of American culture has been to direct the reader's attention to the social environment of living human beings, whose behavior psychology is attempting to understand and predict, especially the social environment of those who live in one of the Western European cultures. The culture is made up of things, of automobiles, bombs, cabbages, deodorants, emeralds, fireplaces, goal posts, hospitals, and so on to zodiacs, which people can use for their own purposes or which, as Emerson warned, can climb into the saddle and ride people. The nonmaterial aspects of the culture, which are the influential ones for human relations, are the customs, taboos, folkways, values, ideologies, religions, myths, and the like, operating within the social structure laid down by the overlapping social groups and the status hierarchies. Anyone who wishes to understand the psychology of his fellow citizens must look at the individual within this social matrix, see him as a member of certain social groups, with which he identifies and to which he surrenders a portion of his sovereignty, locate his position in the socioeconomic hierarchy, and sympathize with him as he tries to mount higher on the ladder of success, defining success, if possible, as he does. It will be easier to do this if we adopt a genetic approach for a few pages, analyzing the social relations of the individual as he develops from an unsocial

vegetative animal, sleeping in his bassinet, to a socialized adult citizen with the responsibilities and privileges that go with his position in society.

## SOCIALIZATION OF THE INDIVIDUAL

In its early, horizontal, crib-enclosed days the infant is not a social being at all. Infant industry is carried on by automatic internal processes, continuations for the most part of processes set going before birth. Its only interest in the outside world is the satisfaction of bodily needs for food, drink, and air, and protection against cold and other discomforts. But when its sense organs mature, as they do very quickly, what would we, from our knowledge of perception, expect the infant's interests to center on? Obviously on those things in his environment which are moving and on those things connected with the satisfaction of its physical needs. Since, in the typical case, the mother fits both these criteria, the mother is the principal object in the infant's narrow range of interests. It is not necessary, in order to explain the fact that the infant's first love is its mother, to drag in any other principles, any instincts, or supernatural forces; the infant's interest in its mother or mother-substitute is a purely natural consequence of the principles of perception and learning and could be predicted therefrom. The perceptual apparatus working the way it does, the infant learns without half trying that its mother is a signal for, and a part of, the pleasant glow that comes from warm milk, dry clothes, and gentle handling.

Gradually the infant learns what to expect from this pattern of stimulation, which intermittently appears within the framework of crib and ceiling, and when it learns that crying, which was a spontaneous or reflex act at first, is often followed by the appearance of the mother, and can, in fact, be used to summon the mother, a big step in social relations has been taken. And these first steps are taken with surprising speed. Only 2 or 3 months after birth, most children will stop crying when they are picked up. The first social smile appears about the same time, usually in response to peekaboo games or fondling. (Don't be fooled by the pseudo smile, merely a sign of gas on the stomach, which is often seen in the first few weeks.) Discriminating friend from foe, a subtle accomplishment that requires more intellectual maturity and more experience, is not usually observed

until the child has enjoyed 6 or 8 months of parental care. At this time the average child can tell a scolding voice from a playful one and a smiling face from an angry one. His social relations then take a positive turn, toward the end of his first year, when he initiates social relations, trying to attract attention by tugging on adults' clothes and banging toys on the floor. From then on, for the first few years, the child's relations with others, whether coming or going, are of this same simple pattern. He does whatever he finds useful in getting what he wants. He cries if that works. He coos if that works better, stretches out his arms, smiles, or throws a temper tantrum and refuses to eat. Whatever the original instigation for these acts, they are strengthened when they are rewarded by affection or nourishment and weakened when these rewards are withheld.

Sometime between age two and three, the child undertakes the supreme intellectual adventure, namely, the creation of his own ego. In the early months of life the infant has no ego of his own, no self. His life is a series of reactions to chemical changes within and physical disturbances without. Indeed, the infant of the first few months recognizes no difference between himself and the rest of the world. Although it may seem weird to well-socialized adults, with their sensitive egos carefully insulated from the rough external world, the infant has to construct, to learn by experience, the boundaries between self and not-self. But such learning is easy, automatic, and unavoidable. The complex of feelings when he bites his toe is different from the feelings when he bites his rattle. When his arm moves across his field of view, the kinesthetic sense organs in his joints and muscles are sending a pattern of nerve impulses to his brain. Not so when it is his mother's arm. Since these feelings, warm, cold, pain, touch, and kinesthetic, are usually included in perception of some objects (parts of his body) and never in perception of others, it is impossible in the normal case not to perceive these objects, after a little practice, as having special significance to him. His concept of himself, then, is a generalization, a pattern, integrated from many discrete experiences in much the same natural and fallible way that he will later learn the concept of "mammal."

Our hero, who now stands on his own feet and perceives them as his own, is maturing intellectually as well as physically and, after age two or so, is able to appreciate more subtle experiences, like his de-

sires, his successes, and failures, as being his own and to include them also in his concept of himself. With the inflexible ardor of a recent convert, he then displays and exercises his own desires, defending them if necessary, in their status as a portion of himself, against all comers. This preoccupation with his own likes and dislikes is the reason for the well-known period of negativism, called "stubbornness" by ordinary parents, which reaches its peak usually between age two and a half and three. His parents and older brothers and sisters, the same ones whom the child formerly saw as bearers of the sweets and the comforts of life, are now seen as barriers to self-assertion.

People will always be barriers to self-assertion, but the negativism of the third year of life does diminish. Why? The answer seems to be that, with the improvement of ability to communicate with others by language and gesture, which takes place from about three onward, his skill in social intercourse increases. Just as the child, having learned to tell his right hand from his left, wants to learn which is the right hand of a person facing him, so, after consolidating his own ego, he enjoys putting himself in the other fellow's shoes, identifying with him, sharing his goals temporarily, and sympathizing with his troubles. This conceptualization of the self is brain play as well as brain work, and the child enjoys it just as he enjoys other recently mastered games. Children between three and six relish games in which they exchange selves with their parents, other children, and even animals. "Let's play like I'm daddy. You're mommy." Trying on other egos is as much fun, in its own right, as trying on new clothes. And, as the child's emotional life steadies and his capacity for frustration develops, he is increasingly able to forego his own immediate gratifications in order to win friends and all the pleasures friends bring with them. He becomes more susceptible to flattery, to praise and blame, and thus more amenable to adult methods of social control. From this point on, our hero's concept of himself will include the reactions of other people to himself, their expectations of him, their acceptance or rejection. His ego will go up and down according to his social success.

But, of course, the child's idea of social success is not the same as the adult's. Children and adolescents rank their friends according to their own set of values: personal appearance, athletic accomplishments, skill in dancing, access to a jalopy, attainment in school, and the like. As the individual nears adulthood, these criteria are replaced—not often

without a wrench, and more completely in some than in others—by those signs of status, such as income and occupation, emphasized by the adult culture.

So the child of five, dashing out the door to play with the other kids on the block, has graduated from the simple physiological rhythms of the newborn babe and is well on his way to becoming a socialized representative of his culture and his social group. He knows what other boys and girls do and what they expect of him. The social interplay of a group of kindergarten or primary-grade children at recess, all trying to get what they want without sacrificing their status in the group, is a splendid study in human relations, an excellent training ground for the development of social skills. At an early level, the simpler social skills are learned, such as saying "Hello" and "Gimme," reaching for things and handing things to others. Children in grade school acquire more sophisticated accomplishments in great variety, but a few of the more common techniques of social intercourse ought to be listed:

How to amuse younger children
How to appear interested
How to ascertain, and conform to, the rules of the game
How to bluff, and when
How to change the subject
How to determine the degree of annoyance that parents and other children will suffer before retaliating—"reality testing"
How to dodge responsibility
How to entertain adults
How to flatter others
How to get along with others without causing trouble
How to get rid of younger children—"the brush-off"
How to patch up a quarrel
How to placate angry adults
How to show sympathy
How to start a conversation with a stranger
How to tease, and when

As the growing boy or girl plays and goes to school with other children, they become more and more important to him. His self, formerly a chip off the family block, takes on the characteristics of the children he plays with. When he grows older, his loyalty to, and

his identification with, his parents will decrease and be replaced in part by loyalty to a gang or club. The youth's friends play a major part in establishing style of dress, language, recreational interests, and attitudes toward adults, and a minor part in the formation of attitudes and sentiments toward larger social issues. Thus a new set of standards, external to the family, enters into the youth's development.

These social groups in which young children play and exploit their social skills are *casual groups*, dependent for their membership on neighborhood proximity, chance encounters at school or playground, and the almost unpredictable vagaries of each child's whims, restricted more or less by parents' prohibitions against undesirables and warnings against minority groups. (Children are democratic by nature, accepting or rejecting other children for *what* they do, not *who* they or their parents are. But they acquire the adult point of view rather quickly.) In contrast to such casual groups are the permanent well-organized *social institutions* established by adults for teaching the young the dominant skills and values of the adult culture.

Of these social institutions the school exercises the greatest influence over the greatest number. All societies have an educational institution of some sort for transmitting adult knowledge, customs, and attitudes to the young, for "bringing them up right," and thus assuring the historical continuity of the culture. As public tax-supported institutions, whose procedures are open to public scrutiny and debate, American schools teach a public-approved subject matter. Publicly sanctioned ideals of cooperation, doing good, being kind, and the like, are also taught by many special groups such as churches, Boy Scouts, Girl Scouts, the three Y's and the Four-H clubs, along with their special organizational points of view. The off-the-record social techniques of the adult culture, how to get ahead of the other fellow, how to cheat a little without actually being penalized, how to rationalize the pressure for success with the emphasis on kindliness, are usually not taught explicitly but are picked up by the youngsters through observation and imitation of their elders.

***Selective factors in socialization.*** It is a mistake, of course, to assume that the social pressures bearing down on children are consistent with one another. All cultures, which the children are growing into, and especially our own, are imperfectly integrated. They give a little here and rub a little there. Just because there are so many conflicts in

our culture, there are many thousands of *pressure groups*, pleading some special doctrine, trying to frighten the blissful or convert the heathen. The well-financed pressure groups with long-time programs naturally establish an "educational" department and turn to the children for long-time support. Add to these the advertisers, whose intentions may be nothing more sinister than the sale of breakfast food, and the volume of propaganda aimed at the nation's children reaches tremendous proportions. The operations of these pressure groups in their efforts to influence children's social attitudes are usually disguised and often highly ingenious. Some are content to infiltrate their literature, models, movies, or airplanes into the schools, completely or slightly camouflaged as informational material. Some try to influence teachers and textbook writers to push their point of view. Some, in a more subtle way, offer prizes for essays that present the donors' position in a favorable light.

Other social institutions, such as churches, junior science clubs, the press, and the military services, bring what pressure they can to bear on the growing boy or girl, encouraging him to develop in the direction of their particular interests in the adult society.

Second, there are *regional differences* within a society that select certain aspects of the culture for emphasis. To illustrate these differences, it is only necessary to consider the lot of a girl taken off the farm and put down in the crowded brick-walled playground of Public School No. 287, or the modification of social relations required of a Northern Negro who travels in the South.

Third, one should consider the *changing times*. Even over a short time span, as from 1934 to 1944, the social pressures on growing boys and girls changed markedly. A boy coming of age during a depression is growing into a slightly different culture than his brother who came of age in boom times. Or compare the socialization of a Japanese girl today with that of a girl in the same city 10 years ago. In the case of economic conditions specifically, we know from interviews with engineers carried out during the depression of the thirties by O. M. Hall[10] that the unemployed were definitely less favorable toward the existing social order than employed engineers with similar backgrounds and training. The unemployed become more skeptical of the established values of the culture and turn their ears more readily to proposals for change. Obviously parents' economic insecurity will

be communicated to their children who, seeing the world of work through their parents' eyes, will see it as a land of insecurity rather than the land of opportunity envisioned by their more fortunate playmates.

As the adult culture filters down to the children via the family and the school, these two training institutions select certain aspects of the culture for emphasis while they soft-pedal others. The *values of the parents and teachers*, in direct contact with the children, are thus of critical importance. The parents and teachers, themselves children of their social environment, are pushed this way and that in their pedagogical efforts by their own temperaments, their comprehension of the social scene, peculiarities of their own social development and reactions thereto, as well as by considered theories of education. Any aspect of the culture may be thus singled out for stress or slight, but those which will exert the greatest influence on the child's development are the values that are held up as good, whether artistic, economic, ethical, social, or intellectual, and ways of handling new problems, whether imitative or creative. And nearly all adults "protect" the tender minds of the young in their care by a selective interpretation of a few indelicate activities of the adult culture. Sex, for one, is diluted and romanticized by the official agencies of instruction, while, around the corner, the unofficial tutors of the gutter hand out an equally but differently distorted exposition. Throw in the movie curriculum on sex, which vibrates fervidly between the official and unofficial versions, and you have planted as cruel a confusion in the minds of the nation's youth as any culture could devise.

Some attempts are being made to correct the unrealistic picture children often get of the adult culture. A few high schools here and there are trying hard to give their pupils a reasonably faithful, full-bodied portrayal of the contemporary social scene, without covering up the warts. And those fortunate youths who go on to college will receive a more adequate introduction to the real social world. But the important selective factor in learning social and political realities is not the mere fact of going to college; it is the student's interests and the courses of study which count. Tests of college students' attitudes indicate that those who take liberal doses of sociology, political science, social psychology, economics, and history, come out, more often than their classmates who skip these subjects, with a deeper interest

in social problems, a more international point of view, and a better understanding of the relation of the individual citizen to public affairs.[11]

On college campuses there are, in addition, many extracurricular organizations, particularly in the larger colleges and universities, which play a selective role in interpreting the culture to their membership. Junior political groups, like the Young Republican Club, and its rivals, expound the parent organization's doctrine. Fraternities and sororities emphasize their own sets of values. The radical groups found in a few institutions operate in the same way, but they may, because of their small size and defensive position, exert a relatively stronger influence on their disciples.

***Individual differences in socialization.*** These illustrations are sufficient to show that the individual's acquisition of the adult way of life in his particular society is inclined this way and that by special groups and institutions within the culture. But the individuals themselves are not all the same; hence they are not equally susceptible to environmental pressures. The food that nourishes one youngster's flesh may give another hives. One would expect, for example, that children who are easily excited would be affected differently by a crime movie than the calmer children. And some have claimed that the emotionally unstable are more likely than the average to pick up radical ideas from their surroundings. Actually there is little evidence for these statements. There is good evidence, however, from several parts of the United States, though it applies only to college students, for a relationship between intelligence and radicalism. College radicals will, on the average, get higher scores on intelligence tests and will make higher grades than their more conservative classmates, although these differences are small and there are many exceptions.[12] The reason for this trend seems to be that intellectual interests go along with intellectual abilities. The more intelligent, and more "intellectual," students take themselves and their social environment more thoughtfully. They read more and—this is probably the essential difference—they read different material. While the bookish students are reading *The Nation,* the others are reading *The Saturday Evening Post* or looking at a picture magazine. Since radicalism in colleges is an intellectual, almost a literary, movement, it follows that it will be espoused more readily by the more literate.

An interesting tie-up is found between psychological insecurity and the juvenile-delinquency road to adulthood. The boy, or girl, who is rejected by his parents, or treated like an outsider at school, or who feels inferior for whatever reason, will in all probability feel a need to elevate his ego in some way.[13] If he lives in a subculture where prestige is obtained by stealing oranges off the pushcart, that is the aspect of the culture which will appeal to him as a way of compensating (see page 54).

No doubt there are other personal characteristics that sensitize growing boys and girls to special aspects of their surroundings, but they are hard to find. Aside from the factors mentioned in this section, the chief selective agencies in socialization are certain individuals, who, by virtue of their prestige, exert a special influence over the young. These may be, as illustrated in the chapter on learning, scoutmasters, clergymen, gangsters, heroes and heroines—from radio, movies, or books—teachers, or athletic coaches. Anyone with whom the youth identifies, or toward whom he is particularly suggestible, will play a leading role in channeling the youth's progress toward adulthood.

So our youth, on the threshold of adult status, has come a long way in his social progress. He knows a good deal about things around him, animal, vegetable, and mineral, and how to get along with many things and people. From his varied personal and social experiences, he has built up an integrated concept of himself, an ego, which differentiates him from his environment and locates him in his culture as a member of various groups, having a known status in society. But no one who is more responsive to his environment than an imbecile achieves complete integration of the forces bearing down on him. Some of the social pressures, to be sure, are interiorized, becoming an integral part of the ego, their commands unquestioned. But the individual also takes many of society's demands into himself only partially, setting them apart as a conscience or *super-ego*, a conceptualized aggregate of many social pressures. Hence the familiar quarrel between the primitive selfish demands of the individual and the "Thou shalt's" and "Thou shalt not's" of society, which children wage openly and noisily, is carried on by adults internally, without sound effects. In this ubiquitous conflict the potency of the super-ego, this "remem-

bered voice of a thousand spankings," waxes and wanes with fatigue, alcohol, the warmth or coolness of the social surroundings, and one's love for the world in general. Its strength is a prime agent in character development, in delinquency, in neurosis, and in happiness.

## SOCIAL CONFORMITY

This shaping of human clay into the pattern of the culture, which we call socialization, has far-reaching consequences for prediction and control of human conduct. We saw in the first chapter how any event that is the end result of the operation of many independent factors is bound to take place with much variation, though this variation is a regular and lawful variation around an average or typical event. Now the social relations of any complex individual in any complex culture are end products of the manifold peculiarities of the individual, multiplied by the bewildering assortment of social forces that civilized life focuses upon the individual. Therefore, according to the mathematics of the case, one would expect that the social relations of 100 adult Americans would differ greatly from one to another, with each one's conduct as unpredictable as the flight of a yellow butterfly. But that just does not happen. If, in meeting an acquaintance on the street, you smile and say "Hello," the response you will get, 99 times out of 100, will be the conventional one. The range of variation will be very small. And the reason is, of course, that the social habits which your 100 acquaintances have acquired reinforce certain modes of greeting and prohibit others. Regardless of his fatigue, the chemistry of his blood, the vigor of his glands, the pressure of his mission, or the charm of his companion of the moment, your acquaintance will usually give the customary response.

So human behavior is not altogether capricious. In social relations, the rule is *conformity*, not variation. Restaurateurs can predict the peaks in their business quite well. Power companies know when the domestic demand for electricity will rise and fall throughout the day. One is likely to overestimate the capriciousness of human behavior, for the same reason that anyone waiting for a bus going north is likely to overestimate the number of buses going south. Looking at it more closely, one cannot see how social intercourse would be at all possible

if people were not in some ways predictable. Society could not run if most of its activities did not run in established grooves.

Just to see how these forces work out in practice and to discover which social pressures make the most people hew to the line of social conformity, psychologists have hidden behind telephone poles to record the behavior of motorists and pedestrians at street corners. They have watched people come to church, to school, and to work, in order to tabulate how many arrive when the rules of society say they should and how many deviate how much from the convention. They have even observed the degrees of conformity to official ritual in churches and have asked about variations from official beliefs. These investigations show in graphic detail how social pressures restrict the normal variability of human behavior and force social conduct to line up to the social norms (see page 8).

Consider first the mundane act of going to work. Time of arrival on the job is the result of the activities of the night before, the love-life of the neighborhood felines, the temperature of the morning coffee, the crotchets of the transportation system, public or private, as well as the harried clock-puncher's own cargo of personal characteristics, like talkativeness, speed of walking, and habits of punctuality, a sketchy enumeration of which would cover several pages. Now, if all these factors vary independently, one would expect on mathematical grounds a very wide range of variation in time of arrival on the job. But this is where the social norm or rule comes in. When people are late, they hurry. When they are ahead of schedule, they slow down, perhaps to drink a second cup of coffee. The result, as any analysis of time-clock records will show, is a heavy concentration of arrivals around the customary time. In fact—and this is one way of bringing so-called intangibles like social pressure into the realm of precise science—the strength of the social pressure can be measured by its effects in producing social conformity.

As the social pressure increases in strength, one would expect an increase in the number of people who conform. And that is exactly what happens.

The evidence comes from the investigations of F. H. Allport and his colleagues at Syracuse University who started the measurement of conformity by recording the behavior of motorists at traffic intersec-

tions.[14] They classified motorists, according to their speed in driving past a corner, into four categories: (1) complete stop, (2) slowing down to a very slow speed, (3) slackening the pace slightly, and (4) going ahead without any alteration of speed. To get a picture of the variation when there is no particular pressure to conform, they began at an ordinary corner where there were no signs and no restrictions

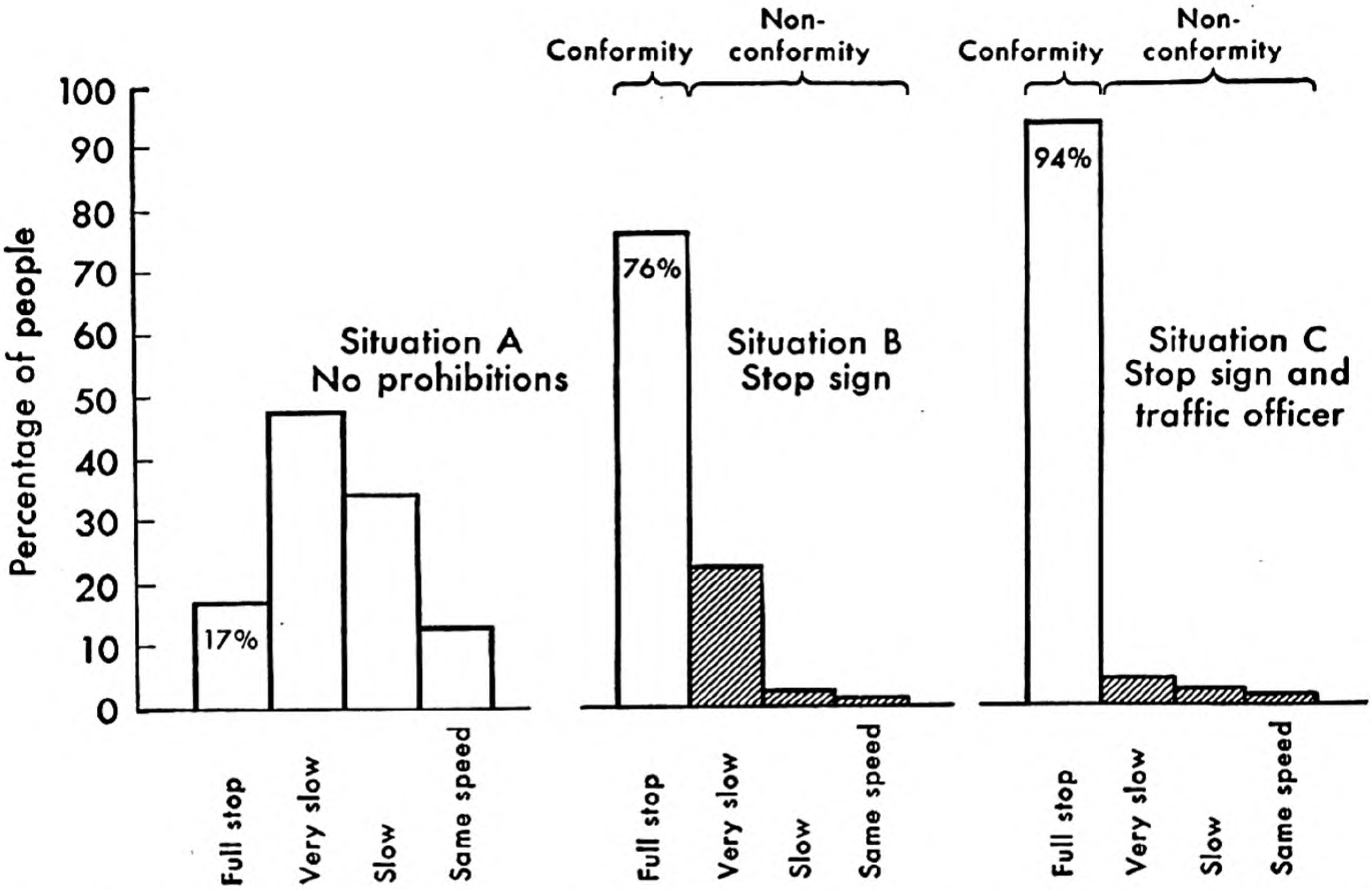


Fig. 90. How social pressures make human behavior predictable. Motorists were observed as they approached three intersections. (*Data from Allport.*[14])

other than the driver's own good sense, a quality that fluctuates greatly. Figure *A* shows what happens in this situation. Behavior is spread out from "Stop" to "Same Speed," with the majority of cases falling near the middle, just as the pennies fell in the game of pitching pennies to a board, which we played in Chap 1. Figure *B* displays what happens when social pressure, in the form of a stop sign, enters the picture. The number who stop increases from 17 per cent to 76 per cent. When there are both a stop sign and a traffic officer, the number who conform increases to 94 per cent, as one can see in Fig. *C*. In both Figs. *B* and *C* we can observe how the driving of these people clusters around the orthodox position at one end of the scale of possibilities, as in pitching pennies to a wall, and the more an act deviates from the norm, the less frequently it occurs.

In the case of religious observances the official position, from whence the pressure comes, is likewise an extreme or ideal at one end of a range of possibilities. If the pressure is strong, the instances that conform will be piled up at or near the official position, while the number who stray from the fold will be fewer the farther they stray. The same group of psychologists observed people in two Catholic churches in Syracuse, N. Y.,[15] dividing their behavior up into three categories: (1) knelt all the way, (2) knelt halfway, and (3) did not kneel. As in the case of the motorists, the largest number of people were conformists, while the half backsliders were few, and the full backsliders were fewer. Likewise, when Catholic students at Syracuse University were asked about their beliefs in God and in prayer, the largest number conformed in their beliefs to the official position, believing in a personal God and in prayer as supplicating favor. A somewhat smaller percentage deviated slightly from this position, but only a few held to the more extreme degrees of nonconformity.

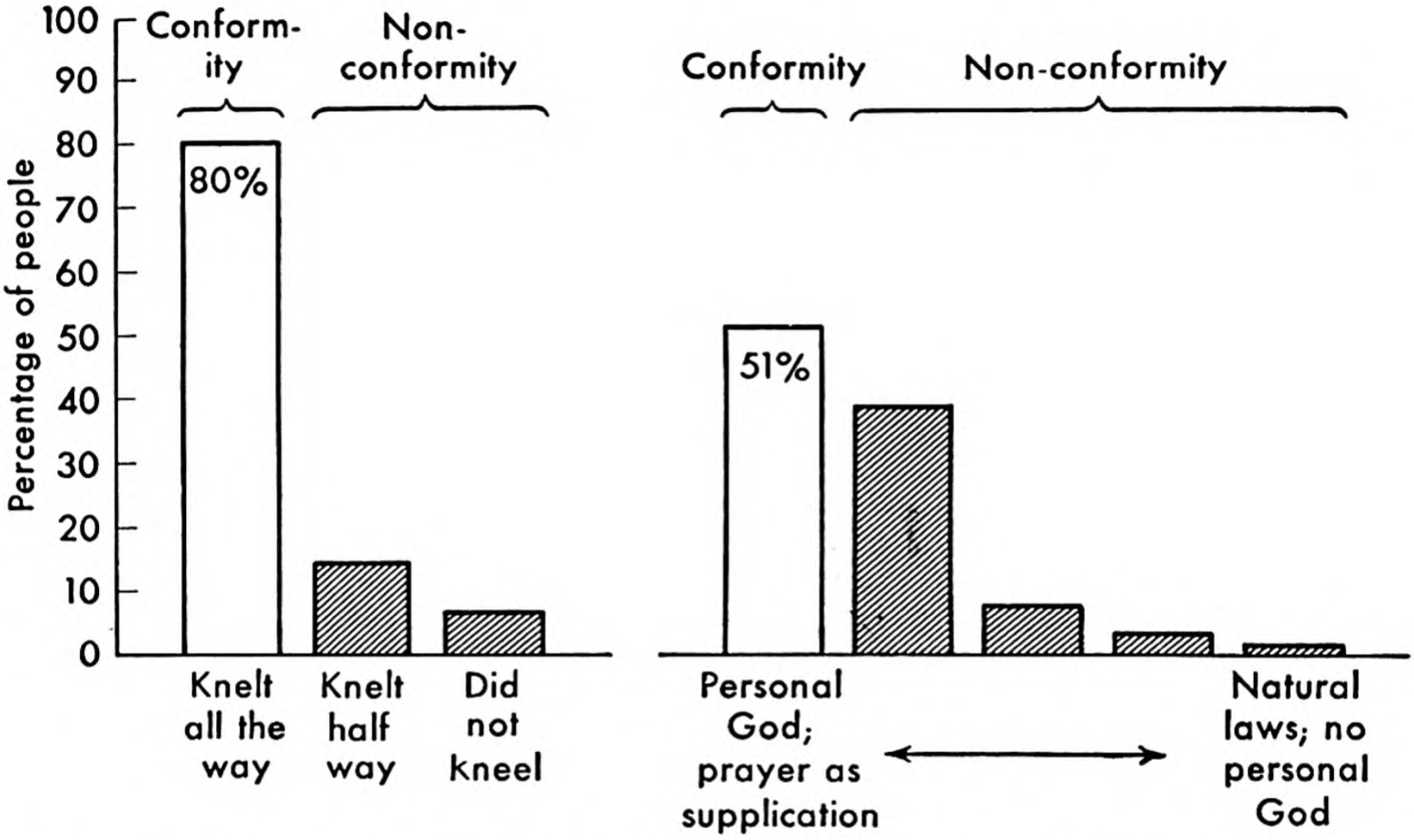


Fig. 91. Conformity in religious practices and beliefs. About 80 per cent of the people observed in two Catholic churches conformed by kneeling all the way, while the others showed different degrees of nonconformity. About 51 per cent of the Catholic students at Syracuse University conformed to the official Catholic beliefs in God and prayer, while the others showed different degrees of nonconformity. In each case extreme nonconformity was less frequent than partial nonconformity. (*Data from Allport.*[15])

These pictures of conformity in a religious group are of particular interest at this point, because they illustrate the tie-up between the socialization process and group membership. Certainly if all the people of Syracuse, or any other large city, were asked about their religious beliefs, the picture would be different. The peak would be nearer to the middle of the range of possibilities. But those students who, when entering the university, indicated membership in the Catholic Church, are influenced by the customs and beliefs of their organization, hence the concentration of cases at the extreme, or official, position. A similar sampling of the beliefs of the members of the Syracuse Society for the Advancement of Atheism (if there were any such) would probably yield a graph with the peak at the right, at or near the official SSAA position, and a few deviators at the left.

The effects of many other cultural forces have been systematically measured by social psychologists in recent years, particularly as they influence language usage (see page 255) and public opinion, but these examples are sufficient to illustrate how the long process of socialization described in this chapter standardizes the social conduct of those susceptible to these forces, with the result that this conduct is pushed one way or the other and thus becomes much less variable. Given the fact of strong social pressure toward a certain pattern of performances or beliefs, one can predict that those who, by virtue of their reading habits, loyalties, or memberships, are exposed to that social pressure will react correspondingly in a fairly uniform way. Conversely, when people in a situation that permits social activities to drift in all directions at once, like maple leaves in an October wind, do funnel these activities into neat predictable piles, one can look confidently for strong social pressure.

Now that the facts of social conformity are fairly well accounted for, the occurrence of deviations from these dull norms takes on increasing interest. We have considered this topic from the intellectual side in the chapter on thinking and will return to it again in the chapter on personality. Without smooth well-lubricated grooves, within which the machinery of social relations can operate, the culture could not hold together and meet the needs of its citizens even as inefficiently as most cultures do at present. Without the rare and disturbing departures of a few unusual individuals from these comfortable grooves, the culture would not progress.

## VARIETIES OF SOCIAL INTERACTION

Whatever else happens, anyone who lives very long is certain to have a lot to do with other people. People cooperate with other people. They compete with other people, openly or covertly. They play games, fight, sit on committees, and chat wittily. They contract to buy and sell. In fact, people seem to do an astonishing variety of things to, for, with, and against other people. Any honest naturalist of human affairs, looking at this lively and confusing social scene, is likely to despair of any attempt to bring these random activities under scientific scrutiny and arrangement. But human relations are not so haphazard as they appear at first glance. The careful observer, in fact, who is able to shed his own social role temporarily in order to stand back and survey this confusing picture at longer range, will see much more regularity than he expected. If his vision is broad, he will discern a few comprehensive patterns of interpersonal relations, a few general directions in which social motivations flow. If status hierarchies and social groups are the anatomy of society, these social processes are its physiology. Obviously the most basic of these processes of interaction is communication.

**Communication.** Learning to understand the spoken word and to speak it, to read, and to write, is a phase of the socialization process, since it involves the acquisition of language habits standardized by the culture. The *passive* vocabulary, meaning the words that are understood, is picked up by simple conditioning at first. A word or phrase is heard, then something is seen or tasted or felt, and so, after several repetitions, the word becomes a signal for the sight or taste or feel. The *active* vocabulary, containing the words the child uses, is built up in the early days by a trial-and-error process. The infant's vocal accomplishments, when his parents give him his first audition, are simple reflexes, which arise in bodily discomfort. Those sounds referring to hunger or pain are soon recognized by adults and appropriately rewarded, but words denominating objects are mastered slowly, and only with adult cooperation. Babbling in his own delightful way, the baby will make a variety of different sounds, including something, let us say, that the precocious parent can recognize as "wa-wa." So he gets a drink of water. The parents at this time will

probably imitate the child and say "wa-wa" also. By some hook or crook the child catches on to the relation between sounds and adult activity. He will then say "wa-wa" when he wants anything, including water. If, however, he is given water and nothing else when he says "wa-wa," the desire for water will become linked to saying "wa-wa." So it turns out that the acquisition of an active vocabulary is at first a matter of accidental production of many sounds, followed by differential reward of some of them, so that specific vocalizations get tied up to familiar objects of desire. But children, being new to this world, generalize more than their elders. "Daddy" means any man. "Kitty" means any animal. Differentiation, the other side of generalization, comes later, narrowing the range of objects to which a sound refers.

When the active and passive vocabularies have fused, chiefly by self-imitation, progress is stepped up because imitation is then easier. From age two, when the average child can recognize a few hundred words, vocabulary expands for many years at an increasing rate. Knowing one word makes it easier, as well as more fun, to learn others. The average five-year-old has acquired some familiarity with over 2,000 of these instruments of communication,[16] and careful estimates place the average for high-school seniors above 80,000.[17] It is difficult to determine the size of the vocabulary of the average adult, but 100,000 would be a fair guess. Estimates of the reading vocabularies of college students run around 200,000.[18] Remembering that man is the only animal with a language of any consequence—for apes can respond to only about a dozen different sounds, hardly more than chickens—the mastery of such great quantities of abstract material must be interpreted as an astounding adaptation to social life.

The psychologists who have made these word counts have all emphasized the variation above and below the averages. The only child, for example, learns words faster than children in a large family. Twins are particularly slow because they can understand each other and get along fairly well without words. It is not likely that these advantages and disadvantages persist into adult life, however. The principal factor in acquiring a large vocabulary, both in childhood and adulthood, is an abstract or *verbal ability*, which is an important component of general intelligence. In fact, the vocabulary test is one of the best tests of intelligence.

Although people learn their words by fair means or foul, in many contexts, and with many false starts, their understanding of the meaning of each narrows down usually to that which is current in the culture or, in literate societies, to the culture's leather-bound file of language habits, the dictionary. Words, like money, are a good medium of exchange just to the extent that they are uniformly offered and accepted in the trade of ideas. It is easy to extol the usefulness of words as standardized vehicles of ideas, and it is just as easy to deplore that ambiguity of words which permits discourse to become tangled in a web of its own weaving. With the aid of modern psychometric techniques, it is possible to measure the degree of uniformity of language usage, just as other kinds of social conformity were measured earlier in this chapter.

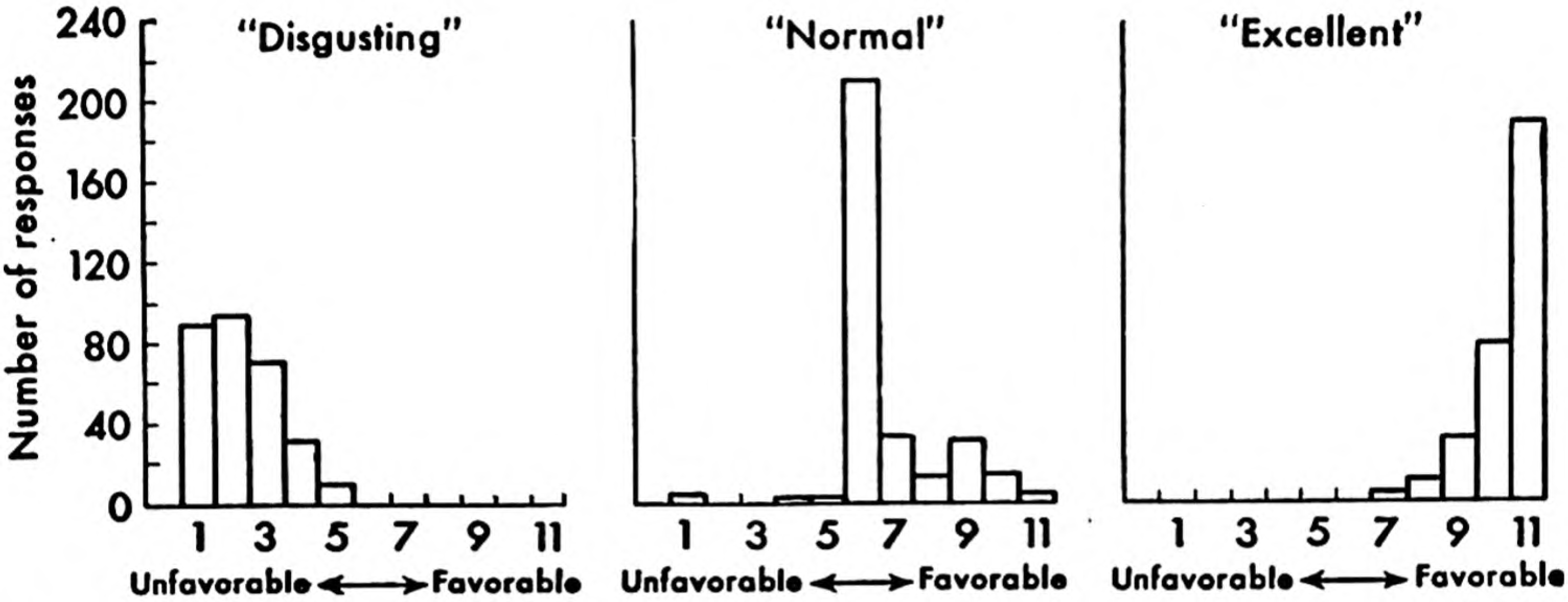


Fig. 92. Conformity in responses to words. College students rated the meaning of words on an 11-point scale from unfavorable to favorable. "Excellent" is clearly a favorable word and "disgusting" is clearly unfavorable though there is some variation in the effect of the latter on college students. There is considerable uniformity in the meaning of "normal" but a few react favorably and a very few unfavorably. (*Data from Mosier.*[18])

C. I. Mosier [19] has measured the variations in one aspect of the meaning, namely, the feeling tone, suggested by several hundred common words. He got college students to rate these words on an 11-point scale in accordance with the impression, from extremely unfavorable to extremely favorable, that they arouse in the reader. It can be seen from the graphs, which are drawn to illustrate the feeling tone carried by three of these words, that conformity in usage of some words is greater than others. Everyone agreed in placing "disgusting" on the unfavorable side of the scale, but they placed it in the three least favorable

categories about equally often. For the word "normal" there was a consensus of opinion that it is a neutral word midway between favorable and unfavorable, but there was a small percentage of students to whom "normal" connotes something good, and an even smaller percentage to whom it brings extremely unfavorable implications. To that extent it is ambiguous. "Excellent" makes a clearly favorable impression. One can be sure, when he uses that word in an educated audience, that its feeling tone will not be misinterpreted. Although Mosier selected the most unequivocal common words he could find, there were several, like "normal," which the results showed to be ambiguous in this one dimension of meaning. A few of these are: acceptable, amazing, bearable, and bewitching. The three graphs, which are to be compared with those on pages 250 to 251, display the range of variation in meaning of three common words and indicate how psychologists gather records of such variation. It is with these fine shades of meaning that conscientious writers spend their working hours, in the hopeless quest for exactitude of expression.

*The utility of words.* A word, like a map, is always a compromise between convenience and accuracy. Because they are so convenient, society places great social responsibilities on words; then periodically the discovery is made that they are not stable enough to carry these responsibilities. It is easy to demonstrate that people do not always say what they mean, or know what they mean to say, and that what others say may stimulate the flow of adrenalin more than the flow of ideas. But the essence of this topic is the question: "What is communicated by words?"

If the word is "apple," the person seeing it or hearing it will perceive a complex stimulus pattern and will recognize it as familiar. Depending on the context of the word and the reader's disposition at the moment, he may anticipate a taste, smell, color, and feeling of delight, or he may recapitulate the story of Adam's fall from grace. Even a familiar word like "long" does not mean the same to an airport engineer as it does to an adolescent boy judging the length of his chin whiskers, and "warm" has different meanings for everyone in summer and winter. But this minor source of difficulty in communication can be controlled if the speaker or writer will make his context clear. Other misunderstandings are more serious.

Taking a case in which the context is clear, as when someone says

"I ate an apple," the reader's response may still differ from the writer's, just because of the differences between the writer's experience with apples and the reader's. The one may be accustomed to large apples, hence his concept of "apple," which is an average of his experiences with apples, will have large apples as its referent, while the other may conceive of small ones. One may react to "apple" with disgust, his remembrance influenced by wormy specimens, while the other may think of the beautiful juicy variety in his uncle's orchard. Therefore two people, such as writer and reader, will necessarily call up slightly different responses to a concept even as familiar as "apple." However, the usual task of the writer is to refer to apples as a class, differentiating them from pears and peanuts, and for this purpose these slight differences of degree are inconsequential.

Going on to words of more abstract content, the difficulty of communication increases. The meaning of a word like "inflation," "truth," "liberal," or "mind" is not learned from direct experience with anything, but indirectly, by putting two and two together, or from teachers, books, and newspapers. It has been shown experimentally that the meaning of such terms varies greatly within the average adult population. But perception of such terms goes smoothly. The printing presses are so very precise and efficient, while ideas are abstract and slippery. Since one can read "truth" about as easily as "apple," he is likely to feel that in grasping the word he has grasped the idea as well, and that his luncheon companion will grasp it with the same effect. For, as Somerset Maugham put it, "there is a certain magic in the written word; the idea acquires substance and then stands in the way of its own clarification."

Not all the trouble can be blamed on words. Any subtle idea, heavily laden with abstract meaning, like "hysteresis," has a hard time crossing the gap between writer and reader, no matter what words are used to transport it. It is true that flowery literary writing can be rendered more intelligible to the average reader by prosaic pruning and rewriting—if communication of information is intended. But if the purpose is an artistic one, the communication of a mood or a vivid vicarious experience, the defloration robs the passage of its *raison d'être*. And when the purpose is the straightforward conveyance of knowledge by the written word, experimental translation of a polysyllabic paragraph

into Basic English, or some other simplified writing system, does not necessarily make it easier to comprehend.[20]

The most serious errors in communication come about when the difficulty of abstract terms is multiplied by the confusing effects of strong emotion. A striking example of such a mix-up is furnished by the word "democracy." The school boy and his teacher, the playwright and his critic, the spokesman for either the NAM or the CIO, all will agree that "democracy" is good. They are uniformly for it, and one will wave the flag as vigorously as the other. One lover of democracy, however, may be referring to the right to a fair profit, another to freedom of speech, another to the right to strike, while a fourth may be trying to recall a quotation from MacLeish. The most inadequate words for precise communication are those which are heavily loaded with good or bad emotional connotations and, at the same time, are intellectually at a high and difficult level of abstraction. A few of the "bad" words are: bureaucracy, capitalist, Fascist, politician, Red, and socialism. A few of the "good" ones are: balanced budget, free enterprise, man of the people, public servant, and statesman.

All this does not mean that emotions are difficult to communicate. Communication of emotion is the stock in trade of actors, poets, and novelists. But the communication of ideas is something different, and a word that is useful for one purpose may or may not be useful for the other. Since the controversial issues of the day are often quite abstract, and since the emotion created by the controversy muddies up the thought processes (see page 36), the popular metaphor "generating more heat than light" aptly describes the familiar outcome. It is not at all uncommon for people on opposite sides of the cracker barrel to talk past each other intellectually while meeting head on emotionally.

*Concerning literary and scientific psychology*. The difference between the communication of emotions and the communication of ideas lies at the bottom of the difference between literary psychology and scientific psychology, and between all art and science. Psychologists, like other scientists and scholars, writing for their professional colleagues and for those who pay their salaries and finance their research, are interested in describing, explaining, predicting, measuring, and proving. For such purposes they use words, tables of facts and figures, charts, and, best of all, mathematical equations, aiming at precision of communication, and employing the style, the conventions, and the

taboos to which their readers are accustomed. The literary psychologist aims at entertainment, communication of emotion, a heightening and broadening of personal experience, and for this purpose prefers vivid language, a nonwearying style, and a point of view that enables the reader to project himself into the story, identifying with one or more of the characters. This purpose leads often, though certainly not necessarily, to an emphasis in psychological novels, and especially in psychological movies, on exciting events, conflicts, sudden changes of conduct and personality, and abnormalities of behavior. Professional psychologists would be inclined to apply the word "psychological" to any novel or play that deals with the description and development of personality, with social relations, or with an analysis of the motivation of the characters—thereby including practically all fiction and biography. A normal marriage is just as "psychological" as a cinema marriage, and a conventional week end is just as "psychological" as a lost week end. Psychologists, and particularly psychiatrists, are astonished and often embarrassed when they see themselves pictured in the movies but, after all, they have probably been misrepresented no more seriously than newspaper reporters, or farmers, or bankers.

It is no longer a military secret that among psychology's many contributions to the Second World War was the improvement of speech intelligibility over telephone intercommunication systems, like those between tail gunner and pilot and between conning tower and torpedo room. When the now-famous National Defense Research Council put psychologists to work on this job, they found that a large share of the errors was due to faulty articulation, use of easily misunderstood words, and holding the microphone too far away from the lips. Vowels are accurately heard; the critical sounds are the consonants, which differentiate "take" from "tape," and "bake" from "shake." In cooperation with other scientists, radio equipment and procedures were tailored to fit the military tasks and the human ear, telephone-talkers' manuals were prepared, training programs were revised, and psychological consultants went to the Pacific with the Navy and the Army Air Forces. These refinements of human engineering increased speech intelligibility, according to a high-ranking Signal Corps officer, about 25 per cent.[21]

*Stereotypes.* Many of these principles of communication are seen in operation in the use of *stereotypes.* This is a picturesque term for the

"pictures in our heads," those stiff, unmodifiable portraits of Babbitts, bankers, bishops, Communists, darkies, Eskimos, farmers, gangsters, Jews, librarians, politicians, Scotchmen, and wrestlers. Psychologically, these are abstract concepts, the content of which includes physical appearance, personality characteristics, and a feeling tone, usually derogatory. Bankers, for example, are supposed to be fat, heavy-jowled men who vote Republican and squeeze money out of widows. Librarians are thin, dry, sour old maids. Any well-socialized American who reads the papers and goes to the movies can add others to the list. Such stereotypes have a function in communication like that of the mythological beings of classical literature. The writer who is writing for an unimaginative audience and who lacks the creative skill to contrive original characters can merely allude to a mythological "Rastus" or "Patrick," add the conventional dialect, and be sure that everyone understands his point. Hurried radio comedians, trying to squeeze their quota of gags in between commercials, can save precious seconds by using a stock Negro mammy, or farmer, or stern but kind judge. The utility of the stereotype in literature, like that of pixies and gremlins, comes not from their accuracy but from their familiarity.

But if one is interested in accuracy of communication, or even polite conversation at a responsible level, the mischief introduced by these stereotypes is serious. There probably *are* differences of one kind or another between librarians and farmers, or between Communists and bankers, but unless one is careful in the use of these labels he is likely to fall into three errors. In the first place, the stereotype, whatever its literary value, may be completely wrong when applied, as it usually is, to flesh-and-blood people. There is no evidence, for example, that Negroes like fried chicken any more than white people, or that bankers are fatter than their depositors, or that musicians have longer hair than bishops. In the second place, there may be actual differences between two groups *on the average*, as there are between Negroes and whites in education, yet the overlapping between the groups is so great that this difference in averages does not help much in referring to a single member of either group. The facts are represented in Fig. 93 for this particular example, and the evidence on nationality and occupational differences, which will be reviewed in a later chapter (see page 335) can always be represented in this way. The picture is one of a difference, large or small, between averages for the groups, with consid-

erable overlapping. Now these differences between averages have significant theoretical and practical implications, but they must be recognized as differences between averages, and the overlapping must be kept in mind or the familiar error of overgeneralization creeps in. Concepts like "apple" and "grapefruit" are convenient for communication of ideas because they refer to two classes of objects, the differences between which are so much greater than the similarities that confusion is unlikely. Not so in comparing people. People differ from each other in so many ways that merely to call a person a "politician" tells very little about him.

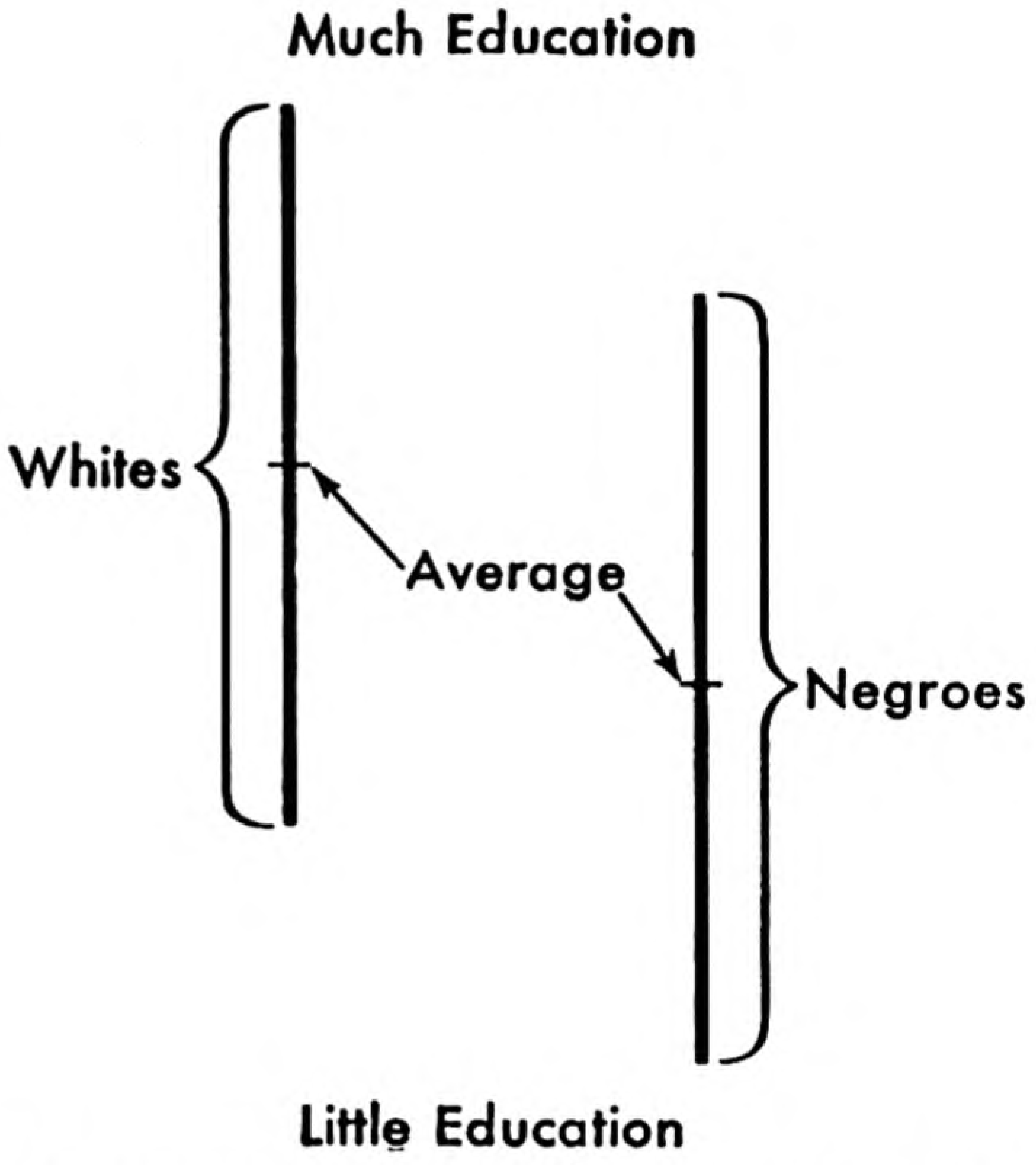


Fig. 93. Comparison of two groups in respect to education. When two groups of people are compared in any respect, the average of one may be higher than the average of the other but usually there is considerable overlapping. Knowing which group any particular person belongs to tells us very little about his education.

The stereotype sabotages communication of ideas because of a third source of confusion, the *type fallacy*, which is the most difficult of the three to clear up. Since the stereotype is current in the culture, a person who fits the stereotype in one way, because of physical appearance (many Negroes), because of his situation and social role (the clergyman in the pulpit, the prisoner in the line-up, the wrestler in the ring), because of clothing (military men and women, nurses), or because of a name (those of foreign descent), is easily perceived as possessing the other characteristics of the stereotype as well. This tendency to type, or stereotype, people, and refer to them thus in social intercourse is a laborsaving device that requires less thought than taking each person on his merits. Many a decent citizen who, in dealing face to face with a specific bishop, treats him as an individual, will turn around and use the word "bishop" as if it designated a clearly distinct breed of human being. A detail like "owski" at the end of a name or "Dr." before it is associated in the minds of many people with a definite complex of personality traits.

Experiments with photographs have demonstrated the suggestive effect of beards, wing collars, tiaras, and overalls.[22] While words, like other mediums of exchange, must always strike a balance between accuracy and convenience, the special deception introduced in this case is that the bishop may fit perfectly into the stereotype as far as appearance goes, though his political views follow the Communist party line. These three sources of confusion generated by stereotypes are aggravated by their emotional tone, for there is something about emotional excitement which increases the tendency toward generalization and decreases the more critical functions of discrimination and analysis.

*Why stereotypes persist.* Granting, then, that these stereotypes lead people to say things that, in their more reflective moments, they do not mean, why do such words live so long? Terms like "homeopathic" and "allopathic," though they were once widely and passionately used and are still to be found in the dictionaries and over the doors of hospitals, have passed out of general usage, while the medieval concept of the Jew and the early American minstrel-show concept of the Negro are in evidence on all sides. There are several reasons for this cultural lag, which anyone interested in the English language, in social justice, or in the dynamics of cultural change ought to know about.

Writers, cartoonists, scenarists, radio gagmen and comic-strip artists use stereotyped characters rather than novel ones for the same reason that they use familiar language rather than Esperanto. When Jack Benny's Rochester drawls into the microphone, everyone knows that he is supposed to be lazy, irresponsible, and afraid of ghosts. Just because stereotypes put over the character, or the joke, with economy and vividness, they are widely used and thus disseminated among the public, including the younger generation. When the youngsters grow up to become either gagmen or general public, they are familiar with the stereotype, hence its utility continues. The circle is closed; a culture trait is perpetuated.

Although stereotypes are propagated by some writers only incidentally, and solely for convenience, they are deployed by others as instruments of attack. Name-calling is a propaganda device of distinguished ancestry, and the orator who can brand his opponent by a colorful phrase that differentiates him from ordinary citizens and classifies him irretrievably among the world's meanies has a weapon of superior fire power. This device is likely to be used unconsciously by the non-

oratorical, thoughtlessly perhaps, or in unadmitted attempt to raise one's own ego by depressing another's. Since many stereotypes refer to minority groups, the durability of these stereotypes is a part of the durability of the group conflict, open or covert.

Still another reason for the longevity of stereotypes is a general principle of perception. We have already seen how the mental set or expectancy influences perception and recall (see pages 109, 169); the influence of stereotypes is merely a special case of this fundamental principle. If a person familiar with the stereotype of librarians expects librarians to look and act like old maids, he will see and remember the cases that fit his preconception. These will reinforce his stereotype, while the negative instances will not extinguish it because they are not perceived as pertinent. It is for this reason that familiarity with minority groups sometimes does and sometimes does not destroy the preconception. Anyone who has observed his own reactions honestly or, even better, has reread the chapter in this book on perception, will agree that what we see depends not only on what is there but also on what we are anticipating. This tendency to structure our experiences, to divide people and things up into separate packages, is a primitive property of the nervous system, more natural than critical discrimination of likes and differences.

Putting all this together, it turns out that a person will think, talk, and write stereotypes when there are conflicts between groups, because he can unconsciously elevate his own ego by debasing another person or group, because he has to organize and label his experiences somehow, and because these stereotypes, already familiar to most people, supply a cheap and easy way of classifying, labeling, and communicating. Working against the stereotyping habit are the editorial policies of the more enlightened magazines and newspapers, the educational activities of some schools and churches, together with any abatement of the social and economic conflicts that motivate the stereotypes.

*Suggestion.* If two people were in perfect communication with each other, so that A's desires and plans of action were instantly grasped by B, without distortion or abridgement by the mechanics of expression, and without interference from B's own desires and plans, B would necessarily accept A's intentions as his own and put them into effect. This does not often happen; in fact the phenomenon is considered as a special, almost an abnormal, type of behavior and is designated by a

special term, *suggestion.* It is not more common than it is just because there are so many obstacles to perfect communication, like lack of attention and lack of understanding, and because B does have ideas and desires of his own.

Since the ability to attend to the requests of others and to comprehend their significance develops early in life, the average child of two will usually respond to simple suggestions. But, as he continues to mature and to consolidate his own ego (see page 240), the critical function develops also. He has ideas and intentions of his own, and an ego to protect, so he submits the suggestions of others to his own self-criticism before acting on them.

All this can be demonstrated quite painlessly by a little game of catch with a boy of twelve any day after school. Throw him the ball regularly a few times until he anticipates your throws, reads your intentions, so to speak, and regularly prepares his stance and his hands for the catch. Then make a pretense of throwing the ball a few times but do not release it. Your guinea pig will bite a few times, but soon he will catch on to your plot and inhibit his reactions. He may even become hypercritical and react to your feint with an elaborate indifference. By experiments of this sort, in which they have induced muscular movements by suggestion, and others in which they have planted ideas and opinions, psychologists have learned that people of high intelligence fall for the suggestions less readily than those of low intelligence—the feeble-minded are notoriously uncritical—and that educated people are relatively less suggestible because they have a larger background of information against which to test the suggestion. Aside from intelligence and education, there are certain personality factors that render some people unusually responsive to social influences. In one form of psychoneurosis, called *hysteria,* a high degree of suggestibility is observed, and these people are prone to adopt whatever symptoms are going the rounds (see page 431). In some psychoses, notably catatonia, a negativistic reaction to suggestion is common (see page 435).

It is a general principle in psychology that people are less critical of, and more susceptible to, the suggestions of those whom they respect, those who occupy positions of prestige in society. Advertisers and politicians put this principle in operation by having their products and

programs endorsed by movie stars, novelists, athletes, and men of distinction.

The highest degree of suggestibility occurs in the hypnotic trance. The hypnotist, if he is skillful, induces the subject to ignore other impressions and listen only to the sound of his voice. It requires good cooperation from the subject at first, but as the hypnosis progresses, the subject finds it easy to shut out all distracting influences and to respond only to the hypnotist. The voice of self-criticism is partially stilled also, and, depending on the depth of the hypnosis, the subject observes himself, in a dreamlike way, doing and saying things which he would balk at when fully alert.

***Aggression, competition, cooperation, sympathy.*** Any intelligent observer of the social scene, who sees people impinging on other people, at cross-purposes or parallel, and who realizes his own stake in the outcome, is likely to perceive such activities in terms of their effects on other people, and on the stability of society in general. Political analysts, playground supervisors, and clergymen, as well as social scientists, speak often of cooperation and competition. These and similar terms refer to regularities or patterns of social interaction. They may be called "social motives," along with sociability, social approval, and self-assertion (see page 47). When these main currents of social life are understood in their origin and their fate, the way they integrate and conflict with each other, the richness and turbulence of human affairs are that much more comprehensible and predictable.

The first point to emphasize is that these are forms of *social* interaction. The asocial hermit and the flagpole sitter do not make trouble for anyone, nor do they do anyone any good. In the case of kindergarten children, it has been shown by actual count of each child's contacts with other children that those who are most often sympathetic are most often aggressive.[23] The shy child just does not come into contact with other children so often, either to compete or to cooperate. These varieties of social interaction always have personal causes, in the people who interact, and social causes, in the customs, laws, and institutions of society.

*Aggression* comes as a reaction to frustration. In the simple case of a child whose candy has been taken away from him, the aggression is directed toward the candy-snatcher. But the sequence is not always so direct. In many cases the annoyance is obvious, but the cause is not.

Often a person does not know what he is aggrieved about or, if he does know, he does not admit it, either to himself or to others. In these cases, when the frustration is persistent and annoying, the powerful but rudderless aggression can be steered this way or that, by tradition, by a shrewd leader, or even by the straws of chance, as we have seen in Chap. 3.

The most famous case of large-scale aggression on record is, of course, that of the Nazi organization. The story has often been told, and the psychology behind the rise of the Hitler movement is fairly clear. The frustrations of the times, economic and nationalistic, were channeled by understanding leadership into aggression against the Jews, the international bankers, the Communists, the British, and so on. The danger from these enemies was emphasized by actual events, the best kind of propaganda, such as the burning of the Reichstag. The Nazi organization was portrayed as the one agency which could save the nation from such external and internal dangers. So money and political support were fed into the organization from above, and personnel from below, until it was strong enough to swallow everything.

The same dynamics of frustration and aggression can be observed in a less intense form during any election campaign. All political observers agree that a large share of the vote is a protest vote. When the voters are dissatisfied, for whatever reasons, they tend to vote against someone. It is the strategy of all campaigners to turn the aggression against the other fellow. "He is the source of your trouble. Vote for me." Positive appeals are also effective in politics, but they require a more inspiring leadership. The negative appeals are the dependable stock in trade of the less imaginative campaigners.

*Competition* occurs when two or more individuals or groups want the same thing at the same time. The want may be primary, as when two starving cannibals fight for the same missionary; or it may be the spirit of competition which is dominant, as when two automobile drivers, stopped by a red light, try to beat each other to the getaway. As a rule competition is keener between equals, or near equals. People do not run races with the gods, nor with tortoises.

The unusual thing about *sympathy* is that one person puts himself in another person's place and shares his emotions. This identification with another is neither so unusual nor so metaphorical as it sounds. Everyone who goes to the movies has, at some time or other, left his

own ego in his seat to move up to the screen and, in effect, put himself in the place of the hero or heroine, sharing the celluloid ups and downs. Rises in blood pressure have been experimentally demonstrated in people watching movies wherein the hero is stimulated by anger, fear, and sex.[24] If one does not sympathize with some character of the drama or novel or athletic contest, and feel that the events are happening *to him*, he can be accused of wasting his time.

In real life sympathetic identification with others is more frequent when the two have many interests in common, like mother and child, when they have worked together, sharing common goals, like dancing partners and teammates, and common dangers, like combat crews. Abandoning the customary preoccupation with one's own troubles to move out into the career of someone else implies jumping the boundaries of one's ego, hence is less likely to occur in people who have barricaded themselves behind stiff ego defenses. For this reason children identify with others more wholeheartedly than adults. But adults, because of their better facility of communication and broader experience, can appreciate a wider variety of alien joys and sorrows. In fact, adults do identify with, and feel themselves a part of, large, rather remotely associated social groups, like the airline pilots or the Presbyterians, and even with abstract ideas, like transcendentalism and consumer cooperation.

In contrast to sympathy, which is a passive sharing of emotional experiences, *cooperation* involves sharing goals and taking active steps toward these goals. One person may accept another's goals as his own and work with him when his own goal is the same to begin with, or when he expects to gain indirectly from the enterprise, or merely because he likes the other fellow. The spirit of cooperation between two people is strengthened, of course, when reinforced by a sympathetic emotional identification. Cooperation between members of a group is likewise strengthened when the group is threatened by outside dangers. When a nation is at war, for example, economic groups that ordinarily compete bitterly may join hands and cooperate actively to step up the effectiveness of the nation as a whole, or will usually refrain at least from the sharp individualistic practices that would bring unfavorable publicity down on their heads. When the danger is past, they take up where they left off and cut each other's throats with cheerful prewar ingenuity.

*Origin of cooperative and competitive motives.* Personal experiences, early family training, and perhaps temperamental factors may slant one person in a cooperative direction and another in a competitive direction. It is possible to describe the behavior of a particular person in different situations as "predominantly cooperative" or "habitually aggressive." But that is a small part of the story. If one were to follow a dozen people around for a few days, observing them at work, at home, at church, and at play, he would find that he could predict social behavior, in such matters as helping and hindering, better from a knowledge of the situation in which the behavior occurs than from a knowledge of the people themselves. The customs, institutions, and social pressures encourage aggressiveness at some times and places, and sympathetic sharing at others. Children are expected to "stick up for their rights" when playing with other children and later to be aggressive when looking for a job. But they are expected to be submissive to their parents and other authorities. The ambitious well-socialized boy or girl learns when to express sympathy and when to act hard-boiled, how much individualism is permitted in the classroom and how much at recess, and, in general, what to do in order to gain social approval and get ahead. As he grows up and becomes a good citizen of his culture, it will seem altogether reasonable to him, part of the natural order of things, that he should follow the pattern of the culture, working together with others at certain times and places, and against all comers at others, according to the rules of the game.

Since the rules of the game, the social norms, are the result of history rather than of biology or planning, the activities of any society are both competitive and cooperative at once. In the United States the mail is a cooperative enterprise, run by the government for the people as a whole, while telegraph and telephone communication are carried out by private enterprise. Medical care and the distribution of electric power are partly private and partly public. Retail business is mainly competitive, though consumer cooperatives are growing (see Fig. 94). But it is possible to sort out military, religious, and educational activities as chiefly cooperative, while economic activities are chiefly competitive and individualistic.

In all these cases of cooperative activity there operates a general principle that cohesion within a group is greater when outside danger threatens. In applying this principle, however, one must remember that

the danger must be appreciated to be effective. It is possible for a social group, a whole nation, or a whole civilization to vie merrily amongst themselves for power, prestige, and pelf, ignoring an invisible scourge, like atomic warfare, until the last defenses have been soundlessly battered down. And, in reverse, it is also possible for a shrewd leader to hold a group together by conjuring up the threat of an external enemy. History will record that the unification of the peoples of this one world proceeds a step faster whenever they visualize a common enemy, be it malnutrition, dementia praecox, or invasion from Mars.

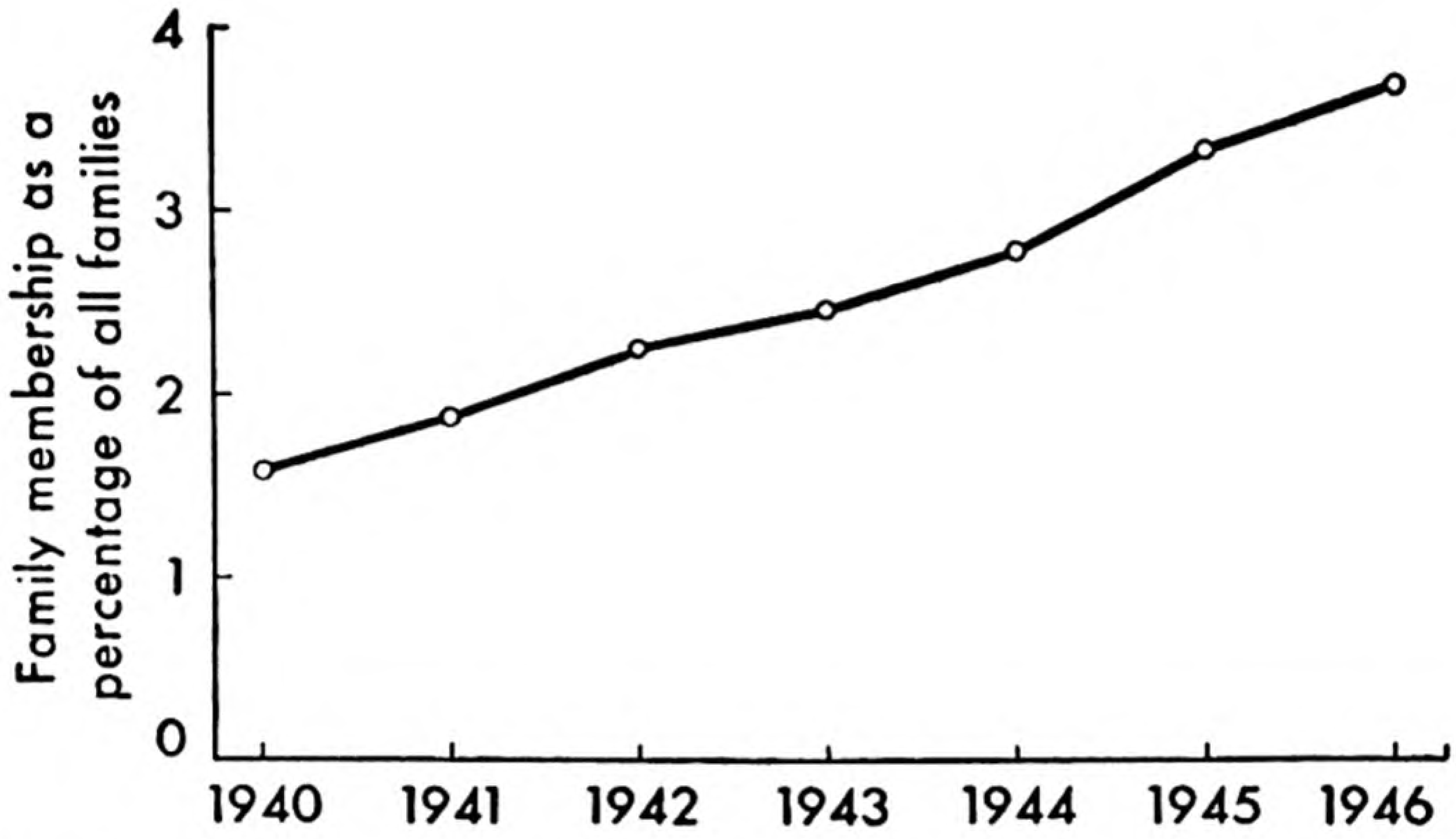


Fig. 94. Growth of consumer cooperatives in the United States and Canada. (*Data from Co-op News Service.*)

Since cooperative and competitive human relations flow out of the cultural pattern rather than the personalities of the individuals by themselves, the search for the origin of these social motives turns to an analysis of cooperative and competitive cultures. Anthropologists, fortunately, have traveled all over the world and have analyzed many different cultures so that they can compare them, including our own, with a broad disinterested perception. They have examined the social and economic arrangements of the Arapesh tribes in New Guinea, the Bachiga of East Africa, the Ifugao of Northern Luzon in the Philippine Islands, as well as American Indians, like the Kwakiutl, the Iroquois, and the Zuñis. Reviewing reports on these many different social organizations, Dr. Margaret Mead, together with her colleagues, discovered that, in the first place, no society was exclusively competitive or cooperative.

> There is furious competition among the Kwakiutl at one stratum of the society—among the ranking chiefs—but within the household of each chief cooperation is mandatory for the amassing of the wealth that is distributed or destroyed. . . . The Maori strove to outdo one another in bird snaring and were honored publicly for their success, but the cooperative distribution of the catch was not affected; the rivalry served only to create higher productivity. . . . In Bathonga (South Africa) a woman's sexual favors are restricted to her husband but her labor is a cooperative activity for the benefit of the entire kraal.

This is almost the opposite of the custom of the Bachiga, farther north, "where each woman works for her husband, but all the related males are permitted to share her sexual favors."

In spite of this seeming diversity some patterns of culture, like that of the Kwakiutl of British Columbia, could definitely be labeled competitive, even by United States standards. And others, like that of the Zuñis of New Mexico, are predominantly cooperative. Why one should be more competitive than another has little to do with scarcity of food or other necessities. All kinds and degrees of competition are found among agricultural, hunting, and fishing peoples, among tribes scratching for a marginal existence and tribes with abundant resources. The important determinants are the social conception of success and the structural framework into which individual success is fitted. In Dr. Mead's words:

> It is possible to summarize the main structural difference between the competitive and cooperative cultures. In the cooperative cultures, there are real closed groups within which the individual's status is defined, and within which he is given security in relation to his fellows; the society depends upon the structure for its perpetuation, not upon the initiative and ambition of individuals. In the competitive cultures, there is no closed society; fighting exists within the group of loosely integrated lineages; no individual is secure in relation to his fellows because success is defined as the maintenance of a status which can be lost or as the attainment of higher relative status; and the culture is organized around the initiative of individuals.
>
> There is a correspondence between: a major emphasis upon competition, a social structure which depends upon the initiative of the individual, a valuation of property for individual ends, a single scale of success, and a strong development of the ego.
>
> There is correspondence between: a major emphasis upon cooperation, a social structure which does not depend upon individual initiative or the

exercise of power over persons, a faith in an ordered universe, weak emphasis upon rising in status, and a high degree of security for the individual.[25]

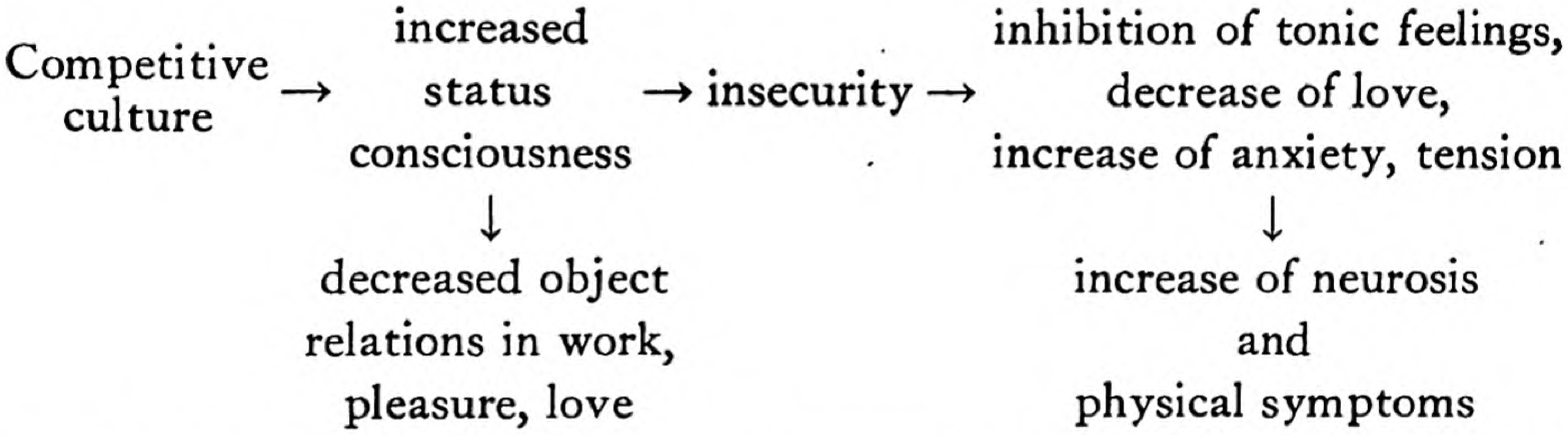
Backing up the anthropologists' diagnosis from a comparison of different cultures are the efforts of historians, sociologists, economists, and philosophers to trace the development of Western European culture over the last three centuries. The significant change, everyone agrees, underlying many more superficial changes, was the rise of that pattern of ideas, values, and customs known as "capitalism." When the merchants of medieval Italy learned how to use cost accounting for calculation of profit and loss, they were enabled to pool risks and profits and thus to promote large-scale commercial ventures, among them colonial expansion. The use of large aggregations of capital in production and distribution came later, with the decline of the independent guilds and the rise of the factory system.

This complex of historical trends, along with their political, social, and economic reverberations, has brought about the pathetic paradox of a culture in which the individualistic struggle to the top of the ladder is encouraged (Get ahead! Get ahead! Get ahead!), whereas actual advancement is distinctly limited except to a few, and those few on top are daily frightened by the possibility of reverses. In a book with the up-to-date title, *Industrial Relations and the Social Order*, W. E. Moore of Princeton University has analyzed the case quite clearly.

> For what is of fundamental significance in the culture of capitalism is its emphasis on the economic individual, that is, the rational, acquisitive, self-interested individual who goes about the pursuit of private ends (generally capable of expression in monetary terms in the forms of wages, rents, or profits) in the most efficient manner possible. His prototype is popularly supposed to be found in the ingenious Yankee, whether as an industrious laborer with reasonable hope of better things, the inventive manufacturer, or the shrewd trader.
>
> This is so much a part of our philosophy that we have come to take it for granted as a part of "human nature." But acquisitiveness is a distinctly modern and Western phenomenon. It is associated . . . with the socially sanctioned dissatisfaction with what one has. It is based upon a moving goal, not a stationary one fixed by tradition. And its emphasis is on the individual, *private* character of production. Thus under the feudal regime one simply

did the appropriate duties required of one's station. Even under the arrangements of the guilds, production was controlled in the interests of the guild as a whole. But under modern capitalism the emphasis has shifted to the individual productive unit, with each individual making the greatest possible effort to achieve a place in the economic world.[26]

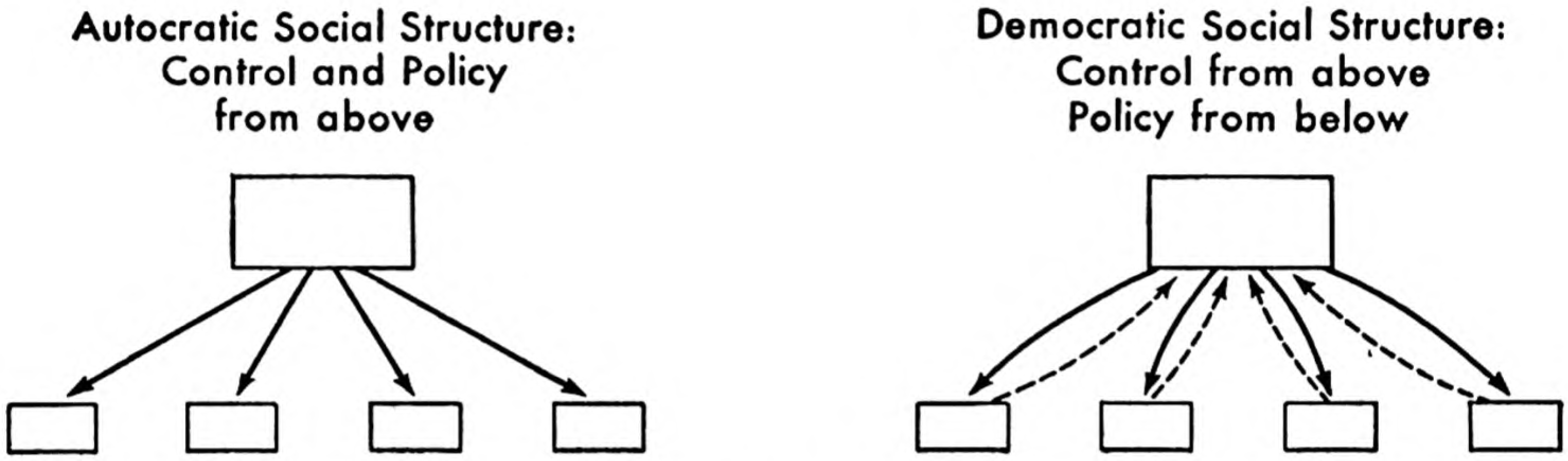
There is good reason to think that the emphasis on success, on the struggle for higher social status, and also the fear of falling lower lead to tensions within the individuals of a competitive culture and perhaps even to physiological changes. Medical examinations have shown that Chinese in the United States have higher blood pressure, as a rule, than Chinese in China. Likewise when success-hungry Americans go to the more placid Orient, blood pressure often falls.[27] Murphy, Murphy, and Newcomb [28] have diagramed the sequence in this manner:



***Leaders and followers.*** A social organization is not an amorphous aggregation of people, like a crowd pushing toward the entrance to the Yankee Stadium. If the group is organized at all, certain members, called *leaders*, exercise some control over others, called *followers*. The psychology of leadership is a complex problem, but basically it is concerned with the source of the leader's control or power and the nature of his relations with his followers, both of which are dependent on the structure of the social group. We can strip off the superficialities and lay bare the vital power relationships of the leader-follower mode of social interaction if we examine for a moment the two contrasting types of social structure: the autocratic and the democratic.

In the rigid *autocratic* type of social group, of which some military and business organizations may be taken as examples, the leaders get their power and their orders from above, as illustrated in Fig. 95, and their relations with their subordinates are, for this reason, largely of the one-way authoritarian type. Leaders of this sort are called official, executive, or *autocratic leaders* because they derive their power from

their official positions and their function is to execute the policies that come down the chain of command from above. The other extreme may be illustrated by a casual playground group on a bright Saturday afternoon when a boy suggests playing a game of follow-the-leader. The leader in this case, called a persuasive or *democratic leader,* is granted his power by the consent of the governed and maintains his leadership just so long as he can convince his followers that he is doing something for them. These two cases are artificial extremes. No military or business organizations are as autocratic as they appear from the charts that hang in the staff headquarters or the home office, and no democracy that accomplishes anything is as loosely organized as a playground group. But all social groups lie somewhere between these extremes, and the important questions of leadership can be fairly well answered if the extremes are kept in mind, for the answers are different in the different social structures.


Autocratic Social Structure: Control and Policy from above

Democratic Social Structure: Control from above Policy from below

Fig. 95. Autocratic and democratic social structures.

Some of the questions that are asked of psychology are "How do people become leaders?" and "What are the characteristics of a good leader?" Young people, in the lower ranks, ask "How can I become a leader?" The higher echelons want to know how to select leaders of men and women. An equally important question, less often raised, is "How can democratic organizations pick good leaders?"

*Democratic leaders.* In casual, loosely organized groups of school children observed at work and play and on college campuses, the leaders are superior to the average in intelligence and come from families of higher occupational status. That much is definite, with the reservation that children of very superior intelligence (IQ's above 160) are often lonely and not as likely to be leaders as moderately superior children (IQ's from 130 to 140). In the early days of the

Russian revolution the leaders came principally from intellectual and professional backgrounds.[29] In America business leaders come overwhelmingly from business families.[30] Other characteristics, such as personality traits, vary greatly in different social groups but leaders are often described by such terms as initiative, self-assurance, extroversion, sympathy, and sense of humor. Naturally democratic groups, which pick their own leaders, will pick people who seem to give them what they want, whether it is prestige, achievement, active fun, passive entertainment, protection, or what not, hence different kinds of groups will have different kinds of leaders, and the characteristics of the leaders will change from time to time with changes in the motivation of the group. Some groups prefer a man or woman of impressive appearance. Some will not have a woman at all. Some abhor bankers. Others want a leader who conforms to the tradition, perhaps one who can orate with the thunder of a Bryan, or who bears an honored name, or looks well in fishing clothes, or resembles the stereotype of a leader, in physique, in background, or in promises. Professional groups, when electing a president, are likely to emphasize professional achievements. The members of many groups, especially religious groups, want a leader to identify with; his success is their success. It is almost impossible to generalize about the public's taste for public figures at various times and places, but anyone who aspires to leadership has to fit, or be fitted to, these requirements.

Getting his power and his policies from his followers, the democratic or persuasive leader puts his program into action by persuading them that it is their program and that in following his directions they are reaching their own goals. To do this the leader must keep in contact with his constituents, with their aspirations and anxieties, their loves and their hates. In the political area this is called going back to the "grass roots" to feel the "pulse of the people." More up-to-date polling techniques are now available also and are in actual use by political, administrative, and business leaders.

The leader who understands the motivation of the people behind him is that much better equipped to stay in front. Necessarily the persuasive leader promotes group cooperation by helping the members to see the similarities in their goals and to discount their differences. In building group loyalty, leaders often try to popularize easily understood symbols of loyalty, such as uniforms, songs, handshakes, salutes,

and titles. Colorful ceremonies and pageantry are effective, especially if the leader occupies a prominent position in the doings. It often appears that these techniques of leadership come naturally to some people—they love them so—but most leaders learn them the hard way, by trial and error and by imitation of other leaders. Furthermore, a device that works well with one group may not work with another. Emotional appeals, for example, are generally more effective than intellectual appeals, but the leader must always guard against the possibility of alienating the section of his followers who are annoyed by emotionalism.

*Autocratic leaders.* In the strictly autocratic setup the leader acquires his power by virtue of his official position, and may therefore be chosen merely for his loyalty to the powers that be, as indicated by seniority, party membership, consanguinity, or capital investment. But even though the lower ranks do not control the policies of the organization, they do have a certain amount of control over their own output or contribution to the whole. So the efficiency of any organization, even a dictatorship, depends more or less on persuasive leadership. To the extent that individual initiative is required, even the authoritarian leader has to be a genuine leader instead of a boss, has to integrate the activities, and particularly the temporary motives, of his subordinates instead of merely dominating them. It turns out that many of the characteristics of the democratic social structure, such as persuasive leadership, are observed in small segments of what is, overall, an autocratic organization. And, for this reason, all the techniques of integrative leadership can often be seen in action in these organizations. In fact it is the large military and business structures, called autocratic because general policies are determined by a few staff members or a board of directors at the top, which, because of unified control and responsibility, are most conscious of the efficiency of the organization as a whole and are most concerned about selecting and training leaders.

*How do people become leaders?* This question receives many answers, some of which have nothing to do with leadership. One reaches the top in some organizations by marrying the boss's daughter, in others by personal popularity, in others by building up a good record of accomplishment, and in others by pure chance. The first thing for

any ambitious young man or woman to do is to learn the actual requirements for advancement in his own organization.

Some large organizations are definitely on the lookout for leaders, but there are no general rules for detecting them. Leaders have to be fairly intelligent, for their job includes planning and teaching. In many jobs technical skill is also required. But aside from these obvious requirements, the emphasis among psychologists interested in leadership has been shifting from selection to training. Some organizations have had good success in training foremen and junior executives, and the military services often teach special courses in the psychology of leadership. Such training courses may consist merely in learning whether to prepare a recommendation in four copies or five, but ideally the training includes the techniques of persuasive democratic leadership. In radical form the effects can be seen most clearly in an experiment done by Alex Bavelas[31] at the State University of Iowa. He observed six leaders in action, noting that they used authoritarian techniques 50 to 80 per cent of the time. Then he gave three of them special training in democratic methods, showing them the importance of democratic attitudes toward group work, sensitizing them to the problems of persuasive leadership and the significance of their followers' goals, and letting them watch movies of democratic, laissez-faire, and autocratic atmospheres (see page 273). Such training to be effective must be given (and taken) in a democratic spirit, not dogmatically. The trainee must have the experience of working under the different kinds of leadership, and must grasp the crucial distinction between the laissez-faire atmosphere (every man for himself, and the devil take the hindmost) and true democracy. This training appears to be surprisingly effective, for the methods of the three specially trained leaders moved definitely in a democratic direction. After training, these three used authoritarian methods only 4 to 11 per cent of the time, but used democratic methods about 80 per cent of the time, and the morale of the group and their output increased correspondingly.

A fascinating case history has been reported by John R. P. French, Jr.,[32] picturing quite vividly the changes in leadership methods used by one leader whose job it was to train scoutmasters for the Boy Scouts of America.

> Before training, Smith's behavior as a course leader was measured by observing one of his training courses for scoutmasters. He had had many years of experience, both as a scoutmaster and as a trainer, and he was an expert on scouting practices; yet he was a poor trainer.
>
> As a leader, he could be characterized as an unsuccessful autocrat. At all times he kept the determination of policy firmly in his own hands. The scoutmasters were placed on a definitely inferior status-level, while he himself maintained the role of the expert who knew all the answers. . . . During the meetings, he continually bragged about the successful scout troop he used to have, and was continually citing his past experience in an ego-boosting fashion. There was almost no consideration of the troops of the scoutmasters who were being trained. . . . When a question was asked, he would frequently interrupt before the scoutmaster could finish his question.
>
> The reactions of the group were apathetic—for the most part they sat and listened in boredom. Almost no interactions among members occurred—their participation was limited to brief questions directed to the leader. By the end of the course all but two members had dropped out, and these two were making excuses to leave the meetings early.

After he had finished conducting this course, Smith attended a training institute conducted by Bavelas in a thoroughly democratic manner. When his turn came, Smith was asked to play the role of democratic leader but his methods were just what they had always been. After some discussion and practice, however, his methods changed so much that, when he was observed conducting another course for scoutmasters, the contrast was as great as in the before-and-after pictures of the patent medicine advertisements.

> Smith's behavior had changed so markedly that the observers spoke of it as a "metamorphosis." Not only did he use about a dozen new specific techniques of discussion leadership, but the general style of leadership was different. He had changed from an unsuccessful autocratic leader to a successful democratic leader. The members of the course took an active part in determining what problems should be discussed, the leader no longer lectured as an "expert," and the whole group atmosphere was changed. The members participated in an easy manner with evident interest and satisfaction. The leader maintained more friendly relations with the members and no longer showed the sharp differentiation of status.

It is easy to see the limitations of democratic methods, which emphasize group participation in planning and policy making and afford the members of the group a feeling of identification with the

organization. Anyone who does not blind himself to the over-all picture of modern society knows that control *is* held by those on top, by the general staff, the general manager, the labor leader, the archbishop, or, in the family group, by the father or mother. There *are* technical decisions, which only an expert can make, and those who invest the capital *do* retain control of general policy. But it is still true —the history of America has proved it on a large scale and the psychologists' experiments on a microscopic scale—that there is room, even within these limits, for democratic leadership, especially by "middle management," and that it pays off in the long run—emphatically so when the going is rough.

## PUBLIC OPINION: METHODS AND RESULTS

Public opinion in a democracy is an important topic for sociologists, political scientists, journalists, historians, and practicing politicians. In addition, it is a fascinating study for psychology because in the formation and shifting of public opinion many of the principles of motivation, learning, judgment, and social interaction can be seen in operation. In the past, historians and political-campaign managers made rough estimates of the attitudes and opinions of the people by talking to leaders of opinion, noting letters written to newspapers and public officials, checking on memberships in political and semipolitical organizations, and by analyzing election figures. The development of the public-opinion poll, one of the most significant inventions of the twentieth century, and the establishment of polling organizations for large-scale operations have given social scientists a new instrument for study of the relations between the individual and society.

***Methods.*** There is nothing essentially mysterious or complicated about opinion polls. The general over-all accuracy with which the polls predict election returns by questioning only a few thousand voters and the errors which occasionally occur are largely understandable, first, in terms of the principles of sampling and, second, in reference to the way the questions are asked.

*Sampling.* The fundamental statistical principle is a simple one that states how accurately the characteristics of a large population can be inferred from the characteristics of a small representative sample of that population. Ask a typical cross section of 1,000 people whether

they expect to vote for Mr. Black or Mr. White. Assume that 56 per cent say "Black" and 44 per cent say "White." From this sampling of opinion one can predict that Black will get 56 per cent of the total vote, and an elementary formula shows that the prediction will have a probable error of 1 per cent. White's chances of winning a majority of the vote of the total population are exceedingly small. It is no more necessary for the polling organization to interview every voter in the country than it is for the physician to examine every drop of blood in his patient's body.

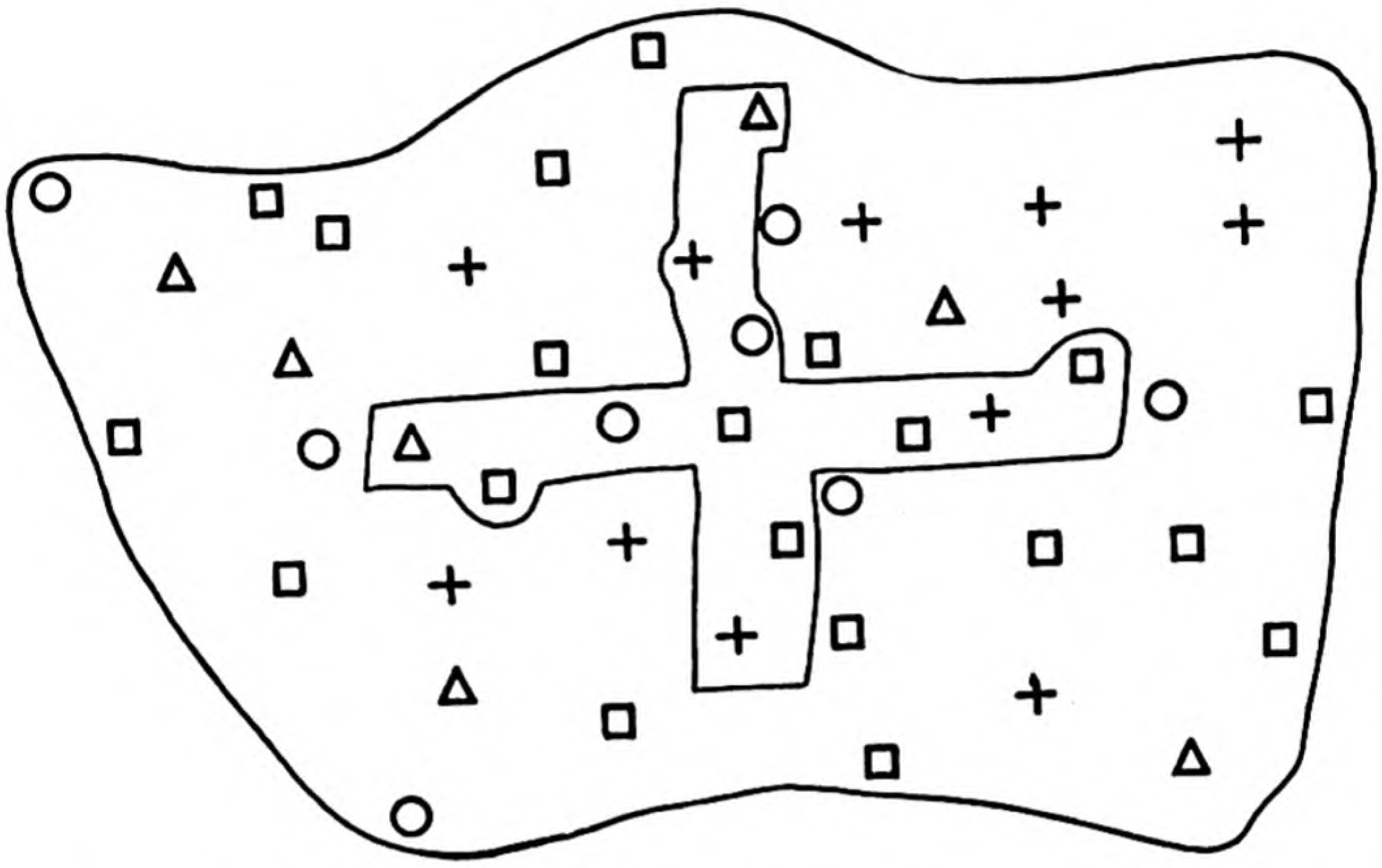


Fig. 96. How the polls set up a representative cross section. We know that the voting habits of the rich are different from those of the poor, Northerners different from Southerners, farmers from city residents, and so on. So we break up the population of the country into several categories of this sort (represented by squares, triangles, crosses, and circles), which we know to be important for voting; then we make up a cross section that will have the same percentage of each of these as there are in the total population. And then we go out and ask this cross section its opinions.

The difficulty in polling is not the size of the sample. No well-run poll ever went astray because the sample was too small. The trick is to poll a *representative* sample, a sample that will be a faithful miniature, in all important respects, of the total population. For the physician this task is easy, because a drop of blood taken from the left ear has the same composition as a drop taken from the right ear or the left finger. But people's voting habits are not uniformly distributed throughout the country, like blood flowing and mixing throughout the veins. In the recent history of the United States, for example, the Democrat vote has been higher in the South, in the cities, and among

the poor. So the polling organization has to interview a cross section of the people, carefully made up so as to include all shades of opinion in the correct proportions. Ideally, the cross section or sample would have the same proportion of voters for Black and for White as in the total population, but this proportion is unknown. What the pollsters do is construct a sample that mirrors the general population in respect to those things which are associated with voting, such as education, occupation, income level, and geographical location. They send their interviewers out to poll a specified quota of men and women in each section of the country, in each income bracket, in each age bracket, and so on. A cross section of the electorate, skillfully stratified in this way, will have approximately the same percentage of voters for Black and for White as the electorate as a whole.

Though the principle of representative sampling is a simple one, the actual practice is more difficult. Small errors creep in here and there, as when bad weather keeps old folks at home, when people change their minds between polling day and election day, and, most important, when the cross section is not precisely representative. For these reasons, when the polling organizations predict an election, they question several thousand people and then are satisfied if their error in forecasting the popular vote does not exceed 3 per cent. To forecast the electoral-college vote is a much bigger operation, which requires an accurate prediction for each of the 48 states. Most polls do what the politicians do, put their extra time and effort on the doubtful states, especially those with a large number of electoral-college votes.

*Asking the question.* The other big problem in opinion research, in addition to the sampling problem, is to word the question so that the answers permit a clear-cut interpretation. For the prediction of a presidential election, it is easy to phrase a simple unambiguous question: "For whom do you expect to vote, Dewey or Truman?" But the prediction of an election is not an important matter, except journalistically. The returns will be published shortly after election day anyhow. Among social scientists, election predictions are valued only as a check on the validity of the polling techniques. The big contribution of the opinion poll to marketing, public administration, and social science lies in the identification and measurement of the psychological factors underlying public reactions to a product, or a political pro-

gram, or a symbol, such as General Electric, OPA, and United Nations—and the trends of these reactions. For such purposes, the wording of the question must be taken seriously, and the more responsible polling organizations have taken the trouble to find out how different ways of wording a question can lead to different interpretations.

The prestige of a well-known name can influence the results, in either direction. In 1939, for example, when the Psychological Corporation [33] asked "Do you like the idea of having Thanksgiving a week earlier this year?" 16.7 per cent said yes. But when the question was phrased "Do you like President Roosevelt's idea of having Thanksgiving a week earlier this year?" 21.4 per cent said yes. About the same time the American Institute of Public Opinion (Gallup poll)[34] indicated that Lindbergh's name attached to a statement about relations with Germany reduced the percentage of people who approved the statement from 57 per cent to 46 per cent.

Nearly everyone—certainly every prosecuting attorney—knows how a leading question can bring out a biased answer. Timely evidence of this factor at work comes from a poll by Elmo Roper, the director of the *Fortune* poll. In 1941 [35] he asked a question about unions in neutral fashion, then loaded it in a prounion direction, and also in an antiunion direction. The questions and percentages follow (see Fig. 97).

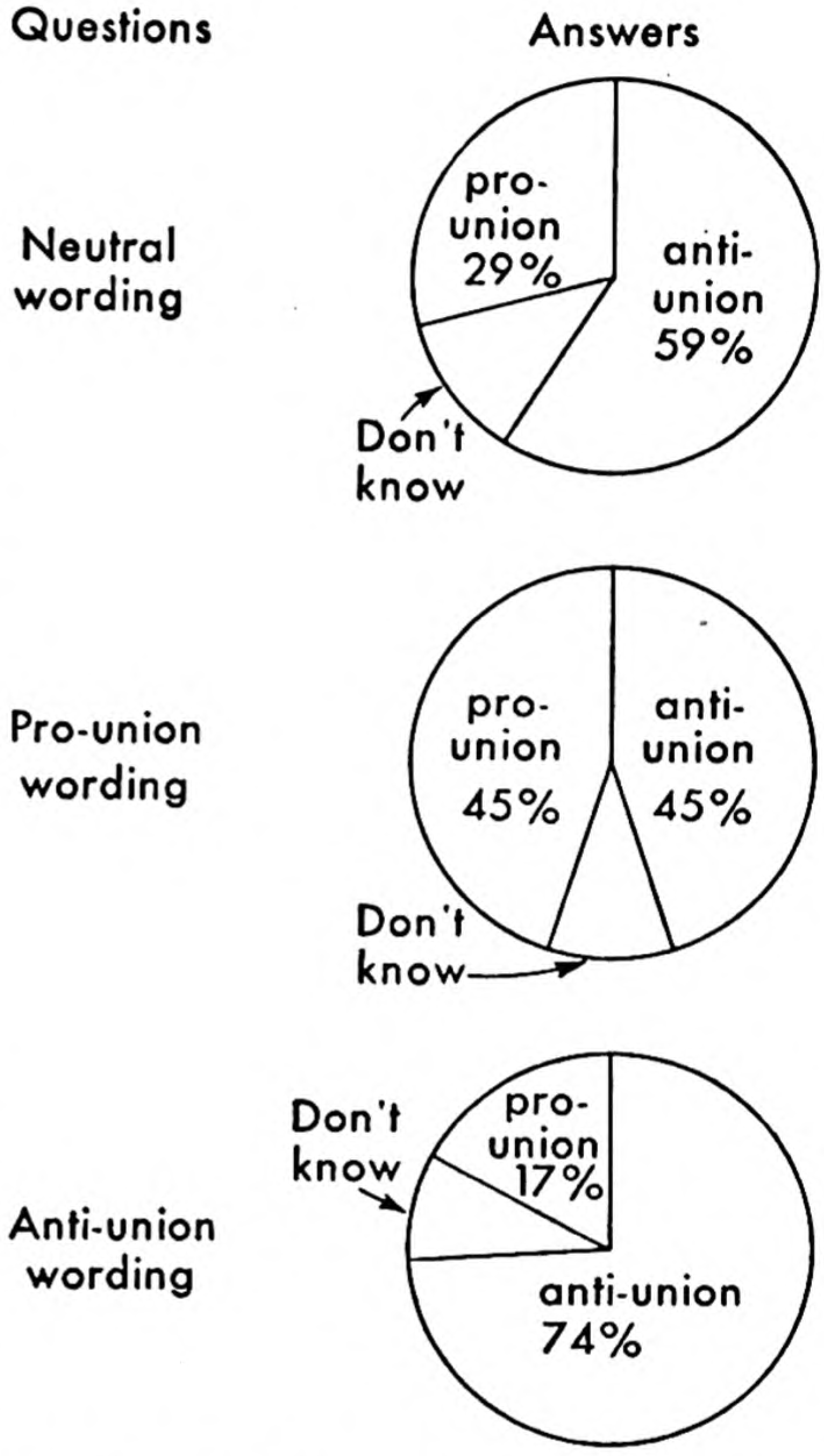


Fig. 97. Effects of "loaded" wording on the answers to questions on a public-opinion poll. The questions are given in the text. (*Data from a Fortune poll.*[35])

*Neutral wording.* Do you think that the government should or should not forbid labor in defense industries the right to strike about working conditions? *Should,* 59 per cent. *Should not,* 29 per cent. *Don't know,* 12 per cent.

*Prounion wording.* Because every man is entitled to safe and healthy working conditions, labor (in defense industries) should be allowed to strike for them. *Disagree,* 45 per cent. *Agree,* 45 per cent. *Don't know,* 10 per cent.

*Antiunion wording.* Because working conditions in this country are the best in the world, labor (in defense industries) should not be allowed to strike about them. *Agree,* 74 per cent. *Disagree,* 17 per cent. *Don't know,* 9 per cent.

These are just a few experiments that show the importance of the wording of the question. When opinion is well crystallized, as in the case of preference for presidential candidates just before election, the effects of changes in the wording are small. When people have really made up their minds, they are not easily disturbed by such subtle influences. As in perception (see page 134), when one set of factors has a clear-cut influence, the influence of other factors is reduced. But when the issue is a new one, which has not yet reached the barbershops and the bridge tables, the phrasing of the question becomes a crucial matter. The careful technicians pretest several phrasings on small groups of people before using the question, and if the results are published in newspapers or magazines, they print the actual question asked and allow the reader to make his own interpretations. When public opinion has not taken sides and argued the question, or when the question can be answered two ways for the same reason or the same way for different reasons, or when the answers suggested do not cover all the possibilities, it is hazardous to try to extract any meaning from the answers. What happens then is that the interested parties interpret the poll as they wish, every man for himself.

**Some results.** For a genuine understanding of public opinion, it is necessary to know the people who hold the opinions and why. People's attitudes toward military conscription, toward control of monopolies, and toward high taxes, for example, are more than tallies in an interviewer's notebook; they are ways of settling personal problems and of expressing loyalties, anxieties, and hopes for the future. What a person means by his general opinion for or against a controversial issue can be probed by asking more specific questions. Broad attitudes, like conservatism in general, are personality traits, which are

tested by attitude tests of the sort described in the chapter on personality. But for many practical political purposes a vote counts the same whether cast in anger, in love, or in cold calculation.

Going to Europe for our first example, here is a question asked by the Norwegian Gallup Institute,[36] Aug. 19, 1946: "In your opinion, which country did the most to prevent Germany's victorv?" The answers:

| | *Per Cent* |
|---|---|
| Russia | 36 |
| U.S.A. | 29 |
| England | 12 |
| Norway | 5 |
| Others | 3 |
| No opinion | 15 |

The value of a poll, for both practical and scientific purposes, is greatly increased when the percentages for and against an issue can be broken down so that opinion in different segments of the population can be compared. In May, 1942, for example, the American Institute of Public Opinion (Gallup poll) [37] asked: "Are you in favor of labor unions?" Here are the results for six occupational groups (see also page 235).

| | *Yes, per cent* | *No, per cent* |
|---|---|---|
| National total | 67 | 33 |
| By occupation: | | |
| Farmers | 52 | 48 |
| Businessmen | 66 | 34 |
| White collar | 69 | 31 |
| Professional | 77 | 23 |
| Skilled workers | 75 | 25 |
| Unskilled | 71 | 29 |

Perhaps one should have expected that the farmers would be least favorable to labor unions, but who would have known before polling them that the professional group was the most favorable?

This kind of analytical research in public opinion is expensive because a representative sample of each group is required. The biggest scientific contribution of the polls will come from breakdowns of this sort, between different educational levels, different religions, different ages, and so on, and from trends in public opinion.

The Psychological Corporation[38] has polled the cities and small towns with the question "Is your family more prosperous (better off) today than two years ago, less prosperous, or the same?" In April, 1946, about half the people said they were "the same," but 26 per cent said they were "better off." The details of the picture, however, are more instructive than the over-all view. When these figures are broken down into four economic groups, A, B, C, and D, in which A is the highest and D the lowest (see page 234), interesting differences show up.

| *Group* | *Per cent* | | |
|---|---|---|---|
| | *Better off* | *Worse off* | *Difference* |
| A. High incomes | 31 | 18 | 13 |
| B. Upper middle class | 23 | 28 | −5 |
| C. Lower middle class | 25 | 24 | 1 |
| D. Low incomes | 30 | 24 | 6 |

The moral of this story of prosperity in April, 1946, is clear. The B income group, those people with only one car and no swimming pool, was the group which was being squeezed from both sides. That was the only income group in which there were more complaining of being "worse off" than there were who thought they were "better off." The poor were holding their own, while the rich, of course, were getting richer.

The Psychological Corporation has been asking that question about family prosperity for several years. In October, 1941, 38 per cent said they were "better off." In October, 1943, the percentage was down to 29 per cent. It was up slightly to 32 per cent in October, 1945, then struck a new low in April, 1946, with 26 per cent (see Fig. 98).

The same organization has been asking this question for three years: "After this war (or, now that the war is over) do you think that we will make a peace settlement that will last, or do you think that we will have another world war in twenty-five years or so?" The national mood in February, 1943, must have been optimistic, for only 43 per cent expected another war and 47 per cent expected lasting peace. But the news, and the interpreters of the news, have steadily darkened the minds of the people. By April, 1946, 62 per cent expected war and only 24 per cent looked for lasting peace. The chart below, made from the data of five polls, shows the gloomy trend of opinion. The only halt in the developing pessimism occurred in the spring of 1945, just after the San Francisco Conference (see Fig. 99).

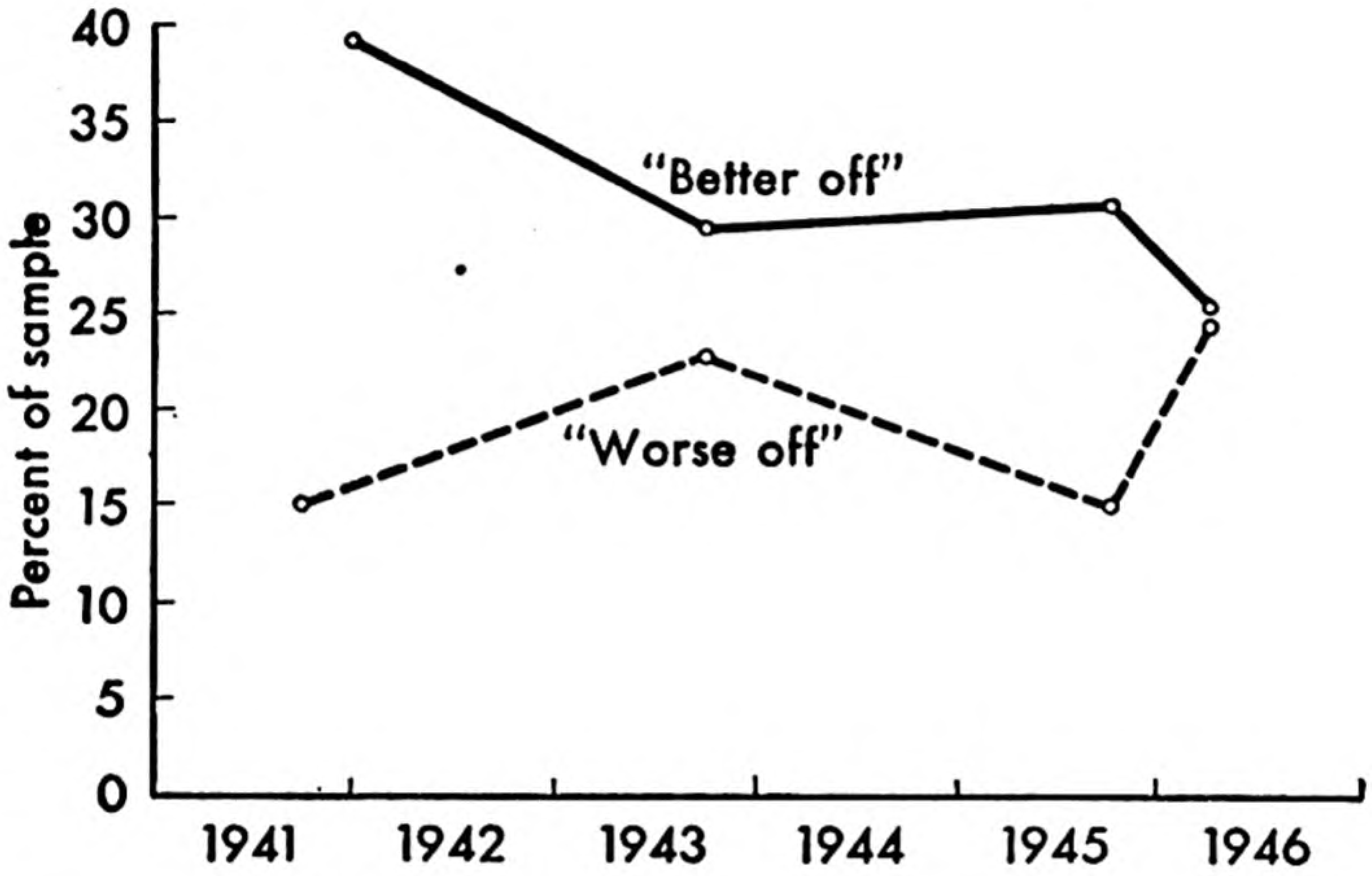


Fig. 98. According to polls conducted between 1941 and 1946 by the Psychological Corporation, there was a general decline in the percentage of people who considered themselves "better off" than they were two years before and a rise in the number who considered themselves "worse off." (*Data from Link.*[38])

By following the fluctuations of public opinion over the years, social scientists have succeeded in tracing out some of the reasons for the fluctuations. Public opinion is not an unpredictable and irresponsible demon. Neither is it a purely intellectual response of thoughtful men and women. But public opinion does respond in its own way to public events. Some of the relations between shifts in public opinion and important events leading up to Pearl Harbor are diagramed in Fig. 100. The frightening effect of Japanese seizure of bases in Indo-China is dramatically charted by the sharp rise in the number of people "willing to risk war with Japan rather than let Japan continue

her aggressions." The readiness of the public to be comforted by good news is illustrated by the drop, after the British defeated the Italian navy, in the number of people who thought it was "more important to help England than to keep out of war." From now on the treatment of public opinion in the history books can, in some respects, be quite detailed and quantitative. In *The History of the Second World War* this chart would look altogether fitting, along about page 70, close after the picture of Mr. Chamberlain's umbrella.

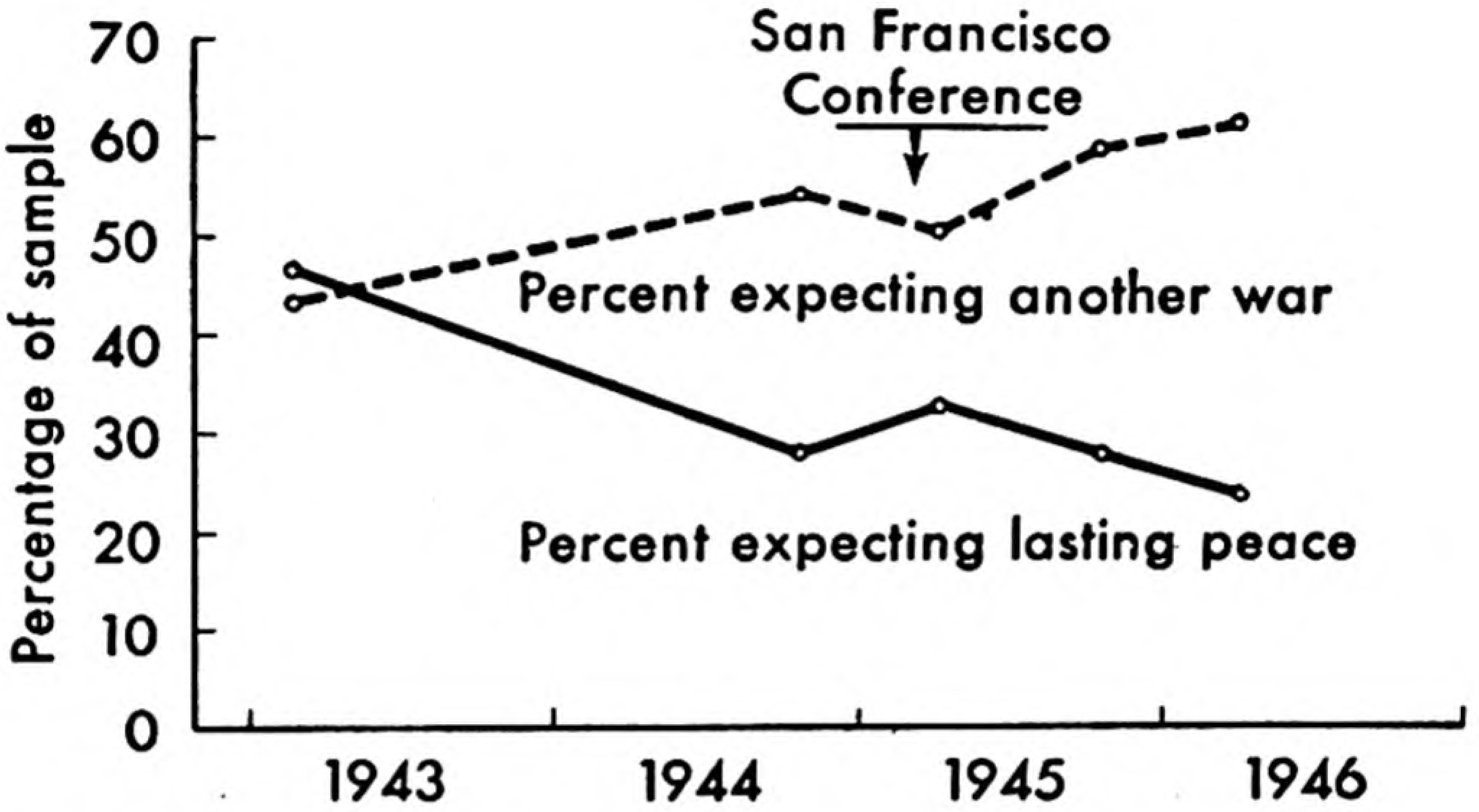


Fig. 99. Trend of American opinion about war and peace. The question was, "After this war (or, now that the war is over) do you think that we will make a peace settlement that will last, or do you think that we will have another world war in twenty-five years or so?" (*Data from Link.*[38])

Keeping track of opinions and events and putting them side by side in this way enable social psychologists to establish certain generalizations or principles of public opinion. The following tentative principles are the first of 16 drawn by Hadley Cantril [39] on the basis of several years' study by the Office of Public Opinion Research at Princeton University.

1. Opinion is highly sensitive to important events.
2. Events of unusual magnitude are likely to swing public opinion temporarily from one extreme to another. Opinion does not become stabilized until the implications of events are seen with some perspective.
3. Opinion is generally determined more by events than by words—unless those words are themselves interpreted as an "event."
4. Verbal statements and outlines of courses of action have maximum importance when opinion is unstructured, when people are suggestible and seek some interpretation from a reliable source.

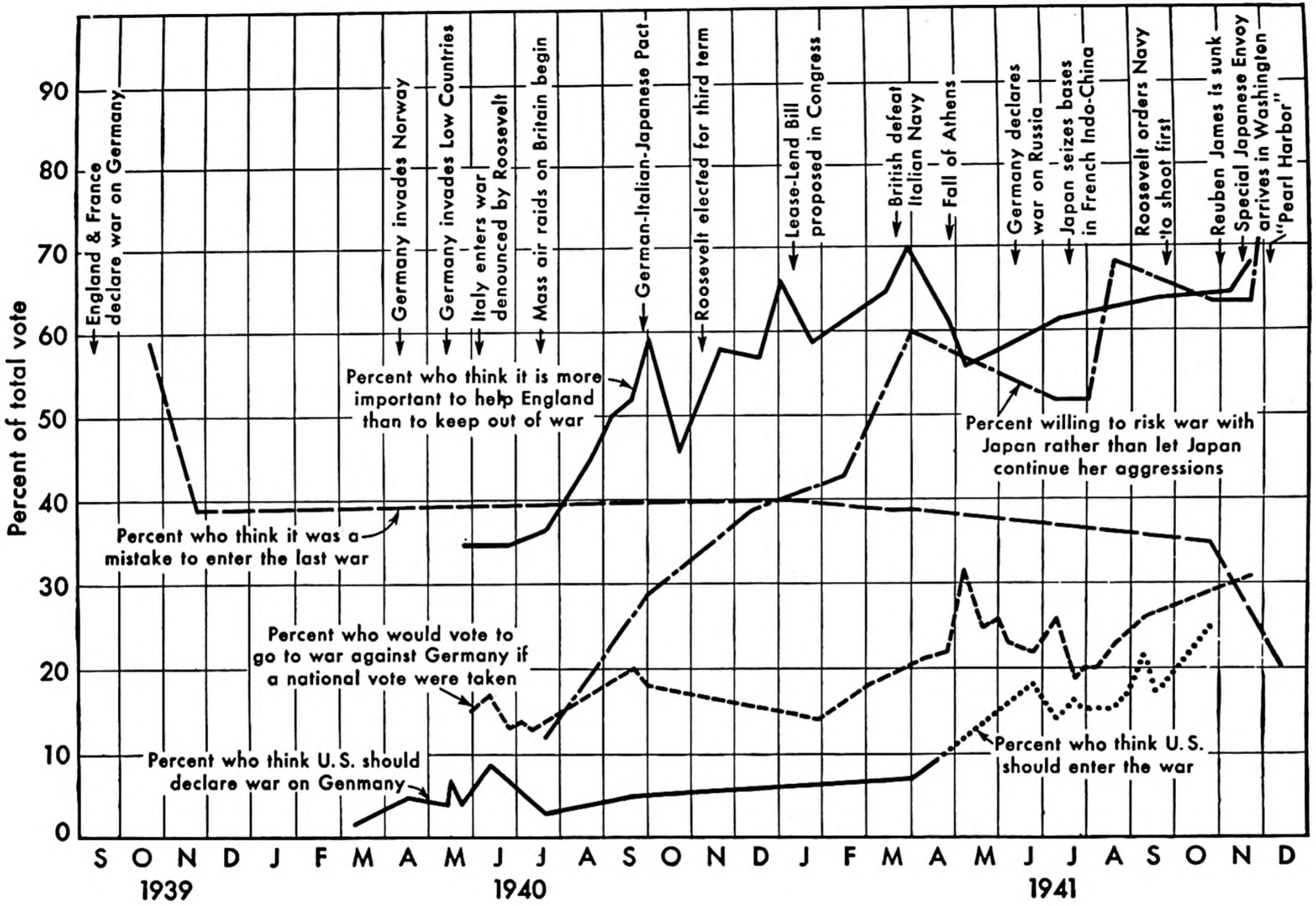


Fig. 100. Some trends of public opinion in the United States together with important historical events leading up to the Second World War. (*From Cantril, Gauging public opinion, Princeton Univ. Press, 1944. By permission of the author and the publisher.*)

5. By and large, public opinion does not anticipate emergencies—it only reacts to them.

6. Psychologically, opinion is basically determined by self-interest. Events, words, or any other stimuli affect opinion only in so far as their relationship to self-interest is apparent.

## SUMMARY: SOME PRINCIPLES OF SOCIAL PSYCHOLOGY

Social development proceeds from the simple, undifferentiated, and pliable behavior patterns of the child toward the complex, specific, and relatively permanent customs and attitudes of the adult society. The aspects of the structure of society that have particular significance for social development are the variety of overlapping groups that the candidate for adulthood may belong to and the status hierarchies to which his rank in society is pegged. Social status in the United States depends primarily on income, occupation, and parentage, and is manifested in privileges, expenditures, and attitudes. People in the lower socioeconomic brackets have certain political attitudes, which are different from those held in the upper brackets, but they do not think of themselves as a distinct class nor have they given up hope for the future.

The infant, growing into and becoming part of this society, gradually learns the adult standards of conduct, the customs, laws, and social norms. He soon thinks of himself as a member of a specific group, or groups, having a specified position in the social structure, with the privileges and duties that go with that position.

This socialization process is not the same for all members of a society, but is slanted in one direction or another by pressure groups, by regional differences, by variations in economic conditions, and by the values of parents and teachers, among other things. At the same time, different individuals are affected differently by the same social variables because of differences in intelligence, emotionality, interests, and the like.

As a result of the socialization process, the behavior of most of the people in any society becomes standardized in many respects. Variability of conduct is reduced and conformity is increased as people are influenced by social customs and laws.

Communication, a prerequisite for the many varieties of social interaction, begins with the spontaneous vocalizations of the young child and progresses, by all types of learning, to the standardized usage of the adult culture. Accurate communication of ideas is facilitated by the use of clearly defined words but impeded by words heavily laden with emotional overtones. Discussions about people are particularly distorted by stereotypes, the formation and persistence of which are understandable in terms of the principles of concept formation, perception, and social conflict.

Suggestion occurs when one person is in good communication with another but suspends his usual criticism of the other's ideas. Aggression usually comes as a reaction to frustration. Sympathy typically depends upon emotional identification of one person with another.

Whether people cooperate or compete depends more upon the social situation than upon the nature of the people themselves. Comparisons with other societies and study of historical trends indicate that the peculiar competitiveness of our society is a consequence of our social structure, which permits a few people to gain high position in the status hierarchy and threatens others with loss of position.

Social interaction between leaders and followers depends upon the kind of social structure in which this interaction occurs. Autocratic leadership is relatively easy, requiring only that one be in a leadership position. Democratic leadership requires above-average intelligence, responsiveness to the motivations of one's followers, and mastery of special techniques.

The formation and fluctuation of public opinion are studied by the public-opinion poll, the accuracy of which depends chiefly upon polling a representative sample and careful wording of the questions. The chief factors associated with people's opinions on public issues are age, geographic location, income, occupation, education, and membership in political and semipolitical organizations. Public opinion is sensitive to important events, reacting in accordance with self-interest in the light of the interpretation of these events by respected leaders of opinion.

## TECHNICAL TERMS FOR SPECIAL STUDY

- socialization
- culture
- primary group
- secondary group
- occupational group
- status hierarchy
- social class
- casual groups
- social institution
- pressure group
- super-ego
- conformity
- passive vocabulary
- active vocabulary
- verbal ability
- stereotype
- suggestion
- aggression
- competition
- sympathy
- cooperation
- autocratic leader
- democratic leader
- representative sample

## NOTES ON TERMINOLOGY

*social pressure:* any social variable that affects human behavior, either by fear of social disapproval or by force. Same as "social force."

# IO

## ABILITIES AND TESTS

At this point we reach a major division in the study of psychology. The preceding chapters have dealt with general principles of behavior, principles of motivation and emotion, perception, learning, thinking, communication, and the others, which apply to all human beings and many animals. Everyone perceives. Everyone learns. Everyone becomes excited at some time or other. And these principles, like the generalization that learning depends upon motivation, are general principles that hold for everyone. There are individual differences, to be sure, in what people perceive, and learn, and what they get excited about, and how much, and how fast. Some information on differences between people in these respects has been collected at the end of each chapter, but the emphasis has been on the general psychological functions.

Now the emphasis shifts away from general laws, and toward differences between people. In the remainder of this book, we will turn our attention to people, people's abilities in this chapter, and their personalities in the next two.

When we speak of a person's *ability*, we mean what he can do. Of course, we never directly observe what he *can do*, but we are able to observe what he *does do* under optimum conditions, *i.e.*, when he is well motivated and not fatigued or distracted. We are not concerned in this chapter with casual or incidental behavior, but with the level of performance a person reaches when we put him in a test situation under good conditions and ask him to do his best. Any procedure, device, or instrument that yields a score representing some significant aspect of a person's behavior in a controlled situation can be called a psychological *test*. Obviously, in order to test a person's ability, we must be able to grade or score his behavior on a scale of goodness or excellence. Individual differences in behavior that are

not easily scored as good or bad, talkativeness, for example, will be considered in the next chapter.

The testing of abilities is an active field of psychology, with theoretical and practical advances constantly being made. According to one estimate,[1] 60 million psychological tests were administered in 1944 to 20 million people in the United States. Historians in later years will no doubt record that the development and use of psychological tests was one of the outstanding scientific accomplishments of the first half of the twentieth century.

The great variety of tests in present use are classified and named according to the ability being tested, the purpose for which the tests are to be used, the method of testing, and in several other ways. When tests are named for the ability being tested, they are referred to as tests of intelligence, mechanical ability, finger dexterity, arithmetic, space perception, and the like. Tests that measure contrasting aspects of these abilities are called speed and power tests. A test is called a *speed test* if the items on the test are easy, as in typing or reading simple material, and the test is given with a time limit. The score, then, represents the rate of doing easy things. A *power test* is made up of difficult items and given with a generous time limit, or none at all. The score from a power test represents, not the speed attained, but the level of difficulty surmounted. For practical reasons many tests are made up with items arranged in an ascending order of difficulty, from easy to hard, and are given with a time limit. On such tests the score represents a composite of speed and power.

When tests are named according to the purpose for which they are to be used, they may be called either achievement or aptitude tests. An *achievement test* is one which is used to get a measure of present performance or knowledge, like the tests used in school at the end of a course, and the tests given to typists who are applying for a job. Contrasted with these are *aptitude tests,* used to predict future performance or knowledge, like those given to college freshmen at entrance, and those given to candidates for a pilot-training course.

Tests are often divided into group and individual tests, according to the method of administration. *Group tests* are easy to use, requiring no complicated instructions and relatively little skill to administer. For this reason they can be given to large groups of subjects at one time. *Individual tests* are more difficult to administer, so the examiner,

who must be specially trained, can test only one person at a time. When tests require much use of language, either in giving the instructions or in answering the questions, they are often called *verbal tests*, as opposed to *performance tests*, in which the subject manipulates objects, like blocks or tools, and the language factor is reduced to a minimum.

When a test has been given to a large number of people and these people's scores have been tabulated and analyzed so that the meaning of a score is known, the test is called a *standardized test*. Tests not yet standardized are used only for research or for special temporary purposes. After a test has been standardized, it is often placed on the market and sold to qualified examiners.

## TEST CONSTRUCTION

Why build a test? There are several reasons. We may merely wish to measure the vocabularies of a dozen people so that we can say which one knows the most words. We may want a test that gives a measure of intelligence in order to recommend that a high-school girl go on to college, or that a college freshman quit and go home, or to advise the legal authorities that a child be committed to an institution for the feeble-minded. We may wish to compare children with their parents so as to gather some evidence on the inheritance of mechanical ability or emotionality. Or the problem may be one of prediction. Of the hundred men and women who enter the employment office tomorrow morning, which ones will be the best employees 6 months from now? Of the thousands of men the draft board is sending to the induction station, which will be useful to the military service and which will be more trouble than they are worth? Which applicant for a job as insurance salesman will sell the most insurance?

Some of these questions can be answered with the aid of psychological tests; some cannot. There are several good tests of intelligence, vocabulary, reading skill, mechanical abilities, clerical abilities, perceptual abilities, and the like. But to predict success on a job requires careful analysis of what the job requires. What does it take to sell insurance? What skills are necessary for operation of a turret lathe?

What are the principal reasons for failure? When a psychologist sets up a program for selection of employees, he will usually prefer to use standard tests, like intelligence and mechanical abilities, if they will do the work, but many jobs in modern industry are so specialized that special tests must be tailor-made to fit them. Construction of a test for the selection of personnel calls for two kinds of expert knowledge, (1) knowledge of the work to be done, whether it is selling insurance, flying a twin-motor bomber, or packing chocolate drops in paper boxes, and (2) knowledge of the technical details of test construction. Often, therefore, experts in these two fields collaborate.

### VOCABULARY TEST

Which one of the five words at the right is most similar in meaning to the word in capitals at the left? Draw a circle around it.

1. ABANDON: abridge, repair, forsake, control, restrain.
2. CONCUR: pay, agree, condemn, hesitate, rebel.
3. FEND: slip, screw, push, deteriorate, defend.
4. LEAGUE: metal, mountain, vertebrate, alliance, vehicle.
5. MATRIX: mattock, slough, epic, suburb, mold.
6. PROBITY: integrity, fever, record, descent, solvent.
7. SCANT: support, limit, blow, scarify, season.
8. VIRAGO: nausea, righteousness, gavot, termagant, sibling.
9. WORK: labor, eat, run, walk, swim.
10. ZECHIN: cinnamon, sheriff, sequin, sequence, zany.

One of the easiest tests to construct is a vocabulary test because any dictionary is an inexhaustible supply of questions, and answers. The set of 10 vocabulary questions printed here is not a standardized test but might constitute about a sixth of a test suitable for educated adults. Dreaming up good questions to test other abilities, mechanical comprehension, for example, is a more arduous creative process, necessitating systematic study of textbooks and technical journals for hints. If the test is to be a custom job, to help in the selection of employees for a specific kind of work or for a course of apprentice training, the psychologist picks up all the suggestions he can collect, from his own experience and the experience of others, from anecdotes heard around the airport, salesroom, or factory, from the complaints of foremen and instructors, and from firsthand observation of good and poor operators in action. He reworks all these ideas, and any other hunches

that sound promising, into the form of questions or problems that can be assembled into a test. Then he is ready to begin.

Writing the questions for a psychological test, in spite of the creative agony involved, is not the most critical phase of the process. Any bright young man or woman around the office can put some together, and, in fact, several of the popular magazines have a corner in each issue where the reader can test his "knowledge of vitamins" or his "literary IQ." Catalogues of test publishers, like seed catalogues, are also full of attractive offerings. The truth is that developing a psychological test is very much like raising a garden. Anyone with a little diligence can learn a few tricks of the trade and soon see bright results in neat parallel rows, as in the vocabulary test above. But will he continue, after that first fine green enthusiasm has wilted, to weed out the undesirables, to thin, and expand, to nurse his project along until it pays? A printing press, like the soil in the back-yard patch, is completely uncritical, and welcomes the bad as gladly as the good. Professional psychologists, however, insist that their tests themselves be tested, and refined, question by question, step by patient step.

Any measuring instrument that aspires to a place in the psychologist's toolbox must reach definite technical standards, two of which go by the names *reliability* and *validity*. It is the struggle toward these standards which makes the construction of a good test a time-consuming and expensive undertaking.

**Reliability.** The purpose of our test, we must not forget, is to compare different people by assigning each one a score, which represents his ability. Whatever ability the scores represent, a test must certainly yield consistent scores, so that if A scores higher than B on one part of the test, he will also score higher than B on the other parts. And if he scores higher than B today, he should score higher than B next week. Technically, that is the meaning of *reliability;* it is a statistical statement of the self-consistency of the scores that the test yields.

No tests are perfectly reliable. They all have some error due to inconsistency. But the best tests give scores that have only a small error of this sort. For example, with a good intelligence test, like the 1937 Terman-Merrill test, a qualified examiner can test a cooperative girl of ten in an hour or so, and get an IQ that will have a probable error of about 3 per cent.[2] That is, if the IQ comes out as 90, there

is an even chance that the error is not more than 2.7 IQ points, one way or the other. (There is the same chance, of course, that the error is greater than this.) A pharmacist, weighing the ingredients for a prescription, would shudder at an error of 3 per cent, but the iceman would not. No one expects extreme precision from psychological tests, but if a professional psychologist does not know that a test is fairly reliable, he simply does not rely on it.

If a test in the process of construction turns out to be entirely unreliable, it is dropped and a fresh start made. But when a test is good enough that it is worth improving, the first step is to find and eliminate the worthless questions, to weed out the undesirables. In the vocabulary test the correct answer to the third question, according to the test constructor's reading of the dictionary was "defend," not "push." But, when the test was first tried out, the people with high scores on the test as a whole gave "push" as a synonym for "fend," while those with low scores preferred "defend." Hence, regardless of linguistic subtleties, this item is inconsistent with the others and should be thrown out. The decision is made on the basis of empirical evidence, not personal opinion or argument. A question that is passed by the high scorers more often than by the low scorers is a valuable question, which contributes its bit to the reliability of the total score on the test. Success on such a question is consistent with success on the test as a whole. Whatever ability is being tested, if those people who do poorly on the test as a whole pass a question, or item, as often as those who do well, that particular item is worthless. It adds nothing to the reliability of the test, in spite of its apparent reasonableness. Comparing each item of the test with the test as a whole in this way discloses the *internal consistency* of the test. This is the principal factor in its reliability for, if many of the test items are inconsistent with the total test, the total score will not be a reliable measure of the ability tested by these items. Careful check on internal consistency and replacement of the irrelevant and ambiguous items with good ones is the chief reason for the high reliability of the best of the present-day psychological tests.

For a rough measure of internal consistency, instead of comparing each item with the total test, the test may be split in half and the score on the odd items compared with the score on the even items.

If the people tested receive about the same score on one half of the test that they receive on the other, the test must be reasonably consistent. Whatever ability is being tested by the odd half is also being tested by the even half. This procedure is called the *split-half method* of calculating internal consistency.

For some purposes the internal consistency of a test may be all we need to know about its reliability. But if we intend to use the test to make predictions about people's future performance, we need to know whether scores on the test will change from day to day or remain stable. To check on *day-to-day consistency*, the test is given to a group of people twice, at an interval of a week or so, and the two sets of scores are compared. Knowing a person's score on a test today, if we can predict his score on another form of the test a week from now with only a small error, the test must be quite reliable. The error or lack of reliability calculated in this way, which is called the *retest method*, includes, of course, any error due to lack of internal consistency. Day-to-day consistency, as measured by the retest method, is usually lower than split-half reliability, as measured by the split-half method, just because the fluctuations in ability from day to day are included in the former. The discrepancy is small for tests of information and intelligence but may be quite large for tests of motor and perceptual skills.

Almost any test can be refined and made quite reliable if it is carefully analyzed and appropriately lengthened, but in practice the test expert must usually compromise between high reliability and convenient length. A well-made vocabulary test of 50 or 60 questions, which can be taken in a half hour, will be sufficiently reliable for most purposes. A reliable intelligence test, however, requires about an hour.

**Validity.** If the reliability of a test is satisfactory, the next hurdle in the path to scientific acceptability is validity. Whatever the function of a test, its *validity* is a statement of how well it performs that function. Obviously a test may be reliable without being valid, because it may give consistent scores but may not be useful for any significant purpose. To be considered valid as a test for the selection of employees, the test must deliver high scores for those who will subsequently make good on the job and low scores for those who will fail. Usefulness is almost a synonym for validity.

The method for determining the validity of a test for any specified purpose is relatively simple in principle, though rather difficult in practice. Let us say, for example, that a test is to be used in hiring turret-lathe operators. In order to find out if the test is useful for that purpose, 100 applicants are given the test and all are put to work. Their scores are recorded and filed. When they have been on the job for a few months, their supervisors are asked to separate the good men from the poor ones. If most of the poor operators made low scores on the test when they were hired and most of the good men made high scores, the test is a valid predictor of success on the job. It is possible in some cases actually to compute how much money the test saves the employer every time a good worker is hired and a potentially poor one is rejected.

Test validity is more important than test reliability, but reliability is usually determined because it is easy to do so, while validity is quite difficult to determine, and also because test reliability is a necessary prerequisite to test validity. Furthermore, the validity of a test will be different when it is used for different purposes. (We will say more about the calculation of reliability and validity later in this chapter.)

**Equivalent forms.** There are many advantages in making a test at least twice as long as it needs to be. Then, after the test has been analyzed, the questions can be sorted into two sets of questions, similar to each other. The two tests, or two forms of the same test, are then known as *equivalent forms.* They are useful for the calculation of reliability and for giving a test over again to someone who has already taken it once.

By procedures of this sort, straightforward in principle but often tedious and expensive in practice, a number of psychological tests have been proved valid and are in daily use in industry, in government agencies, in military services, in schools and colleges, wherever large groups of people are working, raising the effectiveness of the organizations in no small degree. The success of psychological tests demonstrates the value, on the one hand, of an interest in the individual as different from other individuals, and, on the other, of up-to-date statistical techniques, two general intellectual trends of the twentieth century.

## SCORING SCHEMES AND SCALES. STANDARDIZATION

*The mark of a man is a relative mark.* No one cares much whether a man's score on a test of manual dexterity is 37 or 137; the question is whether it is relatively high, medium, or low. Before his performance on a test means anything, it must be compared with some other level of performance. For a test score by itself is like a solitary light seen through a fog. It needs a background, a frame of reference of some sort, before it can do any good. In an employment office it may be enough to know that an applicant is above or below a certain minimum or critical score, established by experience, which separates the potentially successful employees from the failures. But to describe a person's ability more precisely, it must be located in reference to some standard scale of performance, like "Good" and "Bad," or "Grade A," "Grade B," and "Grade C," which tells where he stands among his fellow men and women. Therefore, in order to squeeze the maximum utility out of their test scores, psychologists have been forced to invent age scales and standard scales, and to give the world a new vocabulary of words like "mental age" and "intelligence quotient." All scoring schemes, whether phrased in inches, ohms, or IQ's, have the same function of supplying a standard frame of reference, which, as the chapter on thinking intended to make clear, is a definite help in the evaluation of any object of thought.

**Age scores.** When Alfred Binet, the brilliant French psychologist, faced this problem at the turn of the century, he was impressed by the great increase in intelligence that takes place during the years of rapid growth, so he took this range of ability as his frame of reference. Children of ten are, on the average, definitely more intelligent than children of nine. Children of eleven likewise do better on nearly all tests than children of ten. This regular increase in mental ability up to maturity is a dependable biological fact, which offers an excellent starting place for the establishment of a scoring scheme. Binet arranged his tests in age levels, so that he would have reason to say that Pierre has the intellectual ability of the average child of ten, and that Marie does about as well as the average twelve-year-old. The simplicity of this translation of performance on a test into an *age score* can be readily seen in the table on page 300, which is taken from a modern group test of intelligence, the Otis Beta.[3]

| *Average Test Score* | *Age* |
|---|---|
| 45 | 13 |
| 40 | 12 |
| 34 | 11 |
| 27 | 10 |
| 20 | 9 |
| 13 | 8 |

A table of *age norms*, like this one, is put together in a perfectly straightforward fashion. The psychologist somehow persuades a large cross section of children of ages eight to thirteen, several thousand in this case, to take the test. The average score of the eight-year-olds, if they are not an unusually bright or unusually dull lot, represents average eight-year ability. On the Otis test the eight-year-old children got 13 questions right on the average. The average score obtained by a group of nine-year-old children was 20, and so on. With enough willing children and a calculating machine or two, it is a simple job to compute a score that is typical of the ability of youngsters of a specified age, and to make up a table as Professor Otis did.

Then the process can be reversed. Once a test has been adequately standardized (an engineer would say "calibrated") in this way and a table of age norms is available, the performance of any particular boy or girl on the test can be evaluated against a standard frame of reference, and the usefulness of the test is thereby greatly increased. Knowing a youngster's score on a test, called the *raw score*, one can look in the table and find the corresponding age score, which, if the test is an intelligence test, is the *mental age*. That is all there is to it. If a psychologist gives the Otis test to Mrs. De Giacomo's little girl and she makes a score of 27, he looks in the table and tells Mrs. De Giacomo that her girl has a mental age of ten. Since Mrs. De Giacomo knows about ten-year-old children in relation to eight-year-olds and twelve-year-olds, this way of expressing her daughter's ability is quite understandable.

On intelligence tests of the individual type (see page 292), the separate problems are standardized—not just the total score, as on the group tests—and those problems of the same degree of difficulty are arranged in age levels. The well-known Stanford-Binet test, the 1937 revision of which is often called the Terman-Merrill test, was constructed in this way. The examiner using this type of intelligence test can give the youngster only those problems within his age range, skip-

ping the ones that are clearly too easy or too hard. Scoring the test and getting the mental age is thereby complicated slightly, but the principle is exactly the same as for the group tests. *Any particular child's mental age is the age at which average children have the intellectual ability that this particular child has now.*

One of the principal difficulties in making up a table of age norms is getting a representative sample of children to test. If the children tested in establishing the norms are unusually able, the norms will be too high. If they are below average, the norms will be too low. The correct procedure for getting a representative sample for testing purposes is exactly the same as for carrying out a public-opinion poll (see page 278). When the Terman-Merrill test was constructed, 17 different communities in 11 states were sampled to secure the 3,184 subjects on whom the final standardization was based.[4] These children were further selected according to the occupations of their fathers, in order that the sample would be a representative cross section of the various occupational levels in the United States. (For the relation between intelligence and occupation, see page 337.)

Age scales are very useful, and the mental age, or MA, is a valuable device, which has been exceedingly helpful to psychologists in courts, schools, and clinics. If a psychological examiner reports to the judge of the Juvenile Court that Julia was able to do all of the easy tasks on an intelligence test and three of the hard ones, the judge will be little the wiser. But if the judge hears that Julia has the intelligence of a ten-year-old, it makes sense. The same logic can be applied to measures of physiological or social or educational development, as well as to intellectual, but only when the scores show a regular increase with age does an age scale have any meaning.

**Percentile scores.** When these youngsters finish high school, the utility of the mental-age scale has ended. According to all intelligence tests yet devised, the average youngster of fifteen differs only slightly from one of fourteen. These boys and girls are reaching maturity; their intellectual development, so rapid up to age twelve, slows down after that and soon stops altogether. Mental ages beyond fifteen are "entirely artificial."[5]

For adults, therefore, unless they have the ability of children, some other scale or frame of reference is necessary. The usual procedure in modern psychology is to change a person's test score to some other kind of score, which shows his ability in reference to the ability of

others, regardless of age. The two most common scores for this purpose are percentile scores and standard scores. In order to change a raw score into a score that indicates a person's relative ability in a group, it is necessary to test a large group of people and see how ability is distributed throughout the group.

The most valuable scores would be obtained, of course, by testing all the adults in the country and using the whole range of adult ability as the frame of reference for evaluating any particular adult's performance. Such a gigantic house-to-house canvass has not been done, but two psychologists, Robert Thorndike of Columbia University and George Gallup of the American Institute of Public Opinion,[6] have done the next best thing. We can use their results to illustrate how one ability is distributed throughout the land and to show how percentiles are calculated.

They gave a vocabulary test, similar to the one on page 294 but twice as long and much more carefully constructed, to about 3,000 men and women, constituting a cross section of the voting population of the United States. Our frame of reference, then, is that fraction of the adult population, about 70 per cent, who are eligible to vote. The average score of these representative Americans was 11 words right out of 20. The percentage of people who received each score is shown in the table below.

| *Score, number of words right* | *Percentage of people making this score* | *Score, number of words right* | *Percentage of people making this score* |
|---|---|---|---|
| 9 | 6.6 | 20 | 0.5 |
| 8 | 7.3 | 19 | 1.5 |
| 7 | 6.4 | 18 | 2.4 |
| 6 | 4.9 | 17 | 4.1 |
| 5 | 3.6 | 16 | 6.1 |
| 4 | 2.5 | 15 | 7.2 |
| 3 | 1.3 | 14 | 8.1 |
| 2 | 1.0 | 13 | 8.0 |
| 1 | 0.5 | 12 | 8.5 |
| 0 | 2.5 | 11 | 8.3 |
|  |  | 10 | 8.6 |

Figure 101, which was constructed from the data of the table above, is called a *frequency diagram* because it shows how frequently each score was attained. The largest number of people received scores in the middle range. A few made very high scores, and a few made very low scores. The general shape of the diagram can often be seen more clearly if the tops of the columns are joined by a line and the irregularities smoothed out. Then we have a *frequency curve*. A frequency curve like that of Fig. 101, high in the middle and flaring out at each end, represents a *normal distribution* and is therefore called a *normal frequency curve*. The word "normal" in this case merely means "common" or "usual." This kind of distribution of scores *is* very commonly obtained when a large sample of people is tested with a good test of almost any ability. It is what happens when an event, performance on the test, is the end result of the operation of many independent variables, which in this example are the variables of home training, education, several hereditary factors, and the like. The distribution of scores is much like that which occurs when someone pitches pennies to a board (see Fig. 4), or takes a test of attention span 35 times (see Fig. 37), or when 35 people take a test of attention span once (see Fig. 38). Contrast this curve with the distribution of ability to taste the

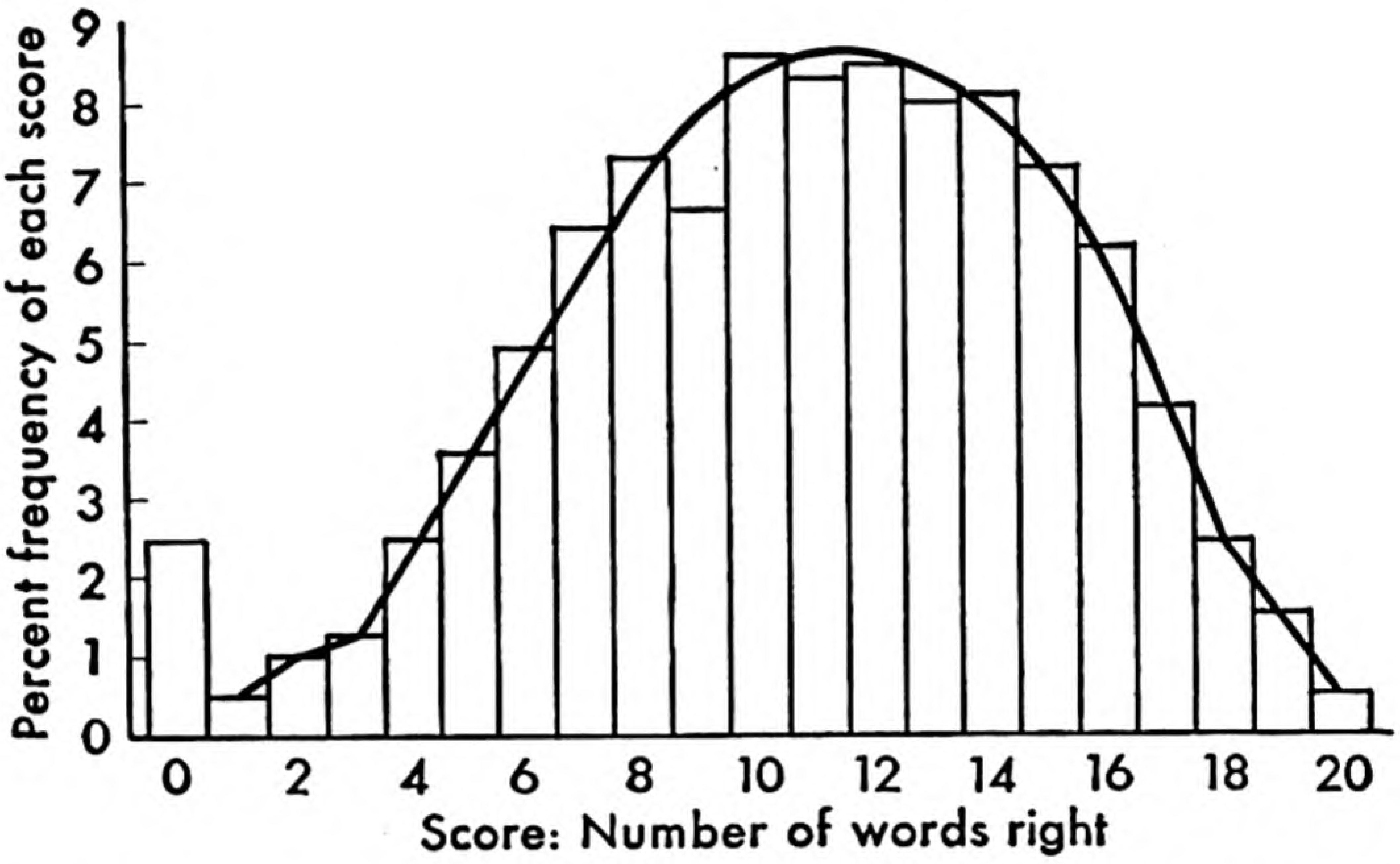


Fig. 101. Vocabulary level of the American voter. A test of 20 words (printed on a card) was given to about 3,000 adults constituting a cross section of the voting population of the United States. The height of each column shows the proportion of people who received each score. The heavy curved line is drawn by eye to indicate the general shape of the distribution. Average score for this sample was 11. It has been estimated that the typical American college freshman would get about 13 right on this test. (*Data from Thorndike and Gallup.*[6])

chemical phenylthiocarbamide (see Fig. 35), which is the result of the operation of just two or three hereditary factors.

Suppose David Stone got 14 words right on this test. Is that good or bad? We can guess from looking at the curve that it is in the upper half of the range of scores. If we want to describe Stone's standing more precisely, we can make up a table of *percentile norms* quite easily from the table on page 302.

| *Raw score* | *Percentile* | *Raw score* | *Percentile* |
|---|---|---|---|
| 9 | 37 | 20 | 100 |
| 8 | 30 | 19 | 99 |
| 7 | 23 | 18 | 98 |
| 6 | 16 | 17 | 96 |
| 5 | 11 | 16 | 91 |
| 4 | 8 | 15 | 85 |
| 3 | 5 | 14 | 78 |
| 2 | 4 | 13 | 70 |
| 1 | 3 | 12 | 62 |
| 0 | 2 | 11 | 54 |
| | | 10 | 45 |

A score of 0 was made by 2.5 per cent. A score of 1 was made by 0.5 per cent. Adding these, we can say that 3 per cent made a score of 1 or less. Adding 1.0 per cent, we can say that 4 per cent made a score of 2 or less. Approximately 5 per cent made 3 or less, and so on. Mr. Stone, who got 14 right, would be interested in knowing that 78 per cent made the same as he did or lower. He might prefer to subtract from 100 per cent and say that 22 per cent were above him.

That is all there is to percentiles. A *percentile score* indicates a person's position in a distribution, *i.e.*, his relative ability, by showing what percentage of the scores are below and above his. Knowing a person's raw score, we can look in the above table of percentile norms and read his corresponding percentile score as easily as we can change a temperature reading from Centigrade to Fahrenheit, or dollars to rubles.

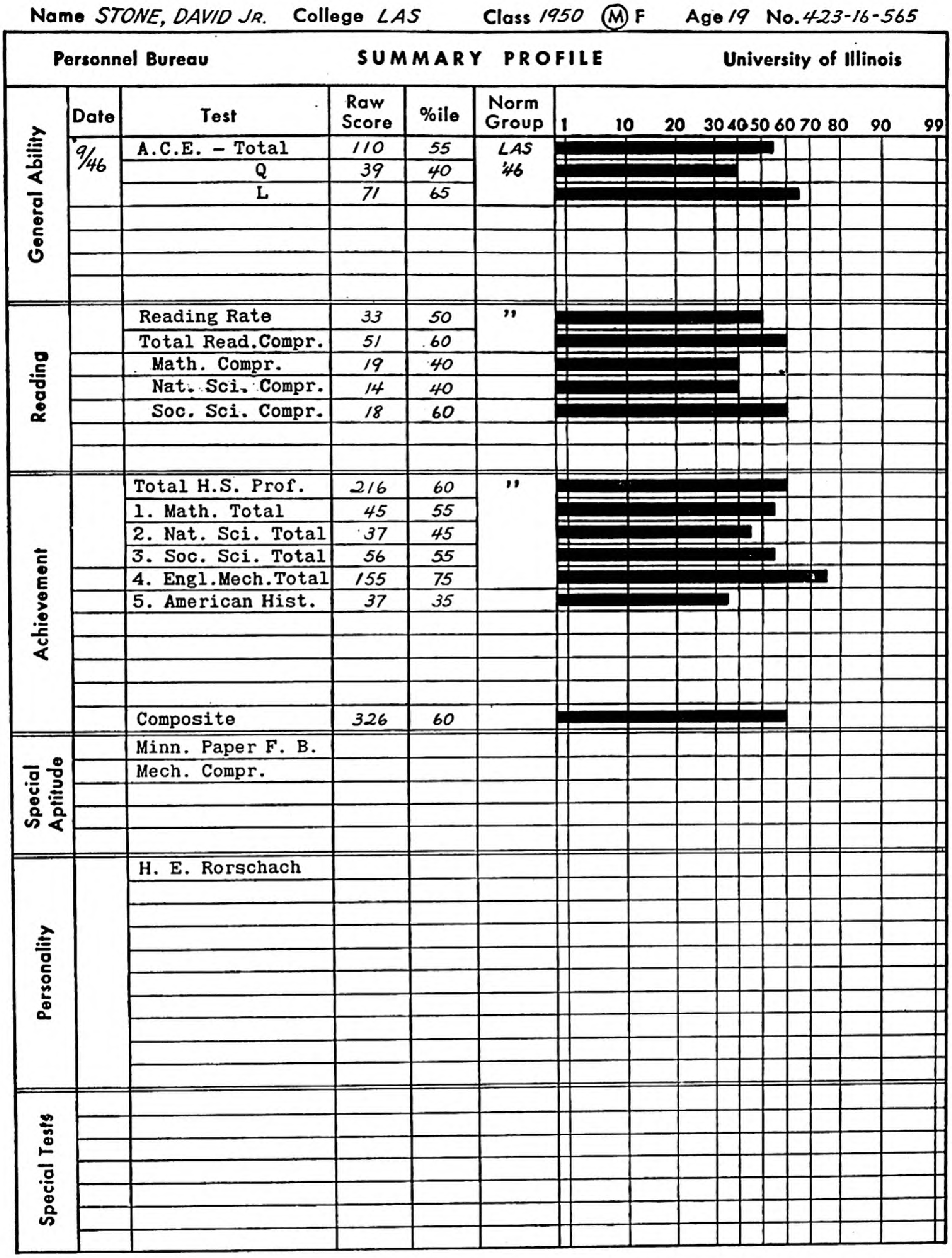
Obviously a percentile score does not tell us much, unless we know the people on whom the test was standardized in order to make up

the table of percentile norms. The table above was based on a representative sample of the voting population of the United States. Colleges often interpret the tests given to freshmen by constructing similar percentile norms for entering freshmen, or perhaps for the whole college population. High schools often make up norms for one large high school, or for all the high schools in one city, or one state, whichever is the most useful and convenient. The important thing to remember about all norms is to ask on what group the norms are based. David Stone's verbal ability, for instance, is at the 78th percentile of the voting population, but if he compared himself to college freshmen in this respect, he would be near the 55th percentile.

When the scores from several tests are converted to one scoring system, such as the percentile system, they can be conveniently displayed in graphic form, as a *profile* or *psychograph*. Figure 102 shows the profile chart that is in use in one large university.

Once we have a table of percentiles at hand we can use it to get further information about the distribution or scatter of ability in the particular group tested. Suppose we want to know the average score. Actually there are several averages, but one that is easy to compute is the median. The *median* is defined as the score above which and below which are 50 per cent of the scores. Looking at the table we can see that 45 per cent got 10 or less and 54 per cent got 11 or less, so the 50 per cent point or median must be about 10½. (Check this by looking at the diagram.) A person who scores above this point can say that he is in the upper half of the distribution. In a similar way, one can compute the 25th percentile. A person who falls at the 25th percentile or lower can say that he is in the lowest quarter of the group tested. (What score would a person have to exceed in order to say that he is in the upper quarter? In the upper tenth? What fraction of the distribution falls between the 25th and the 75th percentiles?) As it happens, the 25th percentile, the 50th percentile, or median, and the 75th are often used in psychology as reference points in describing a distribution of scores.

**Standard scores.** Percentile scores are easy to understand but they have certain disadvantages. For one thing, they do not correspond with ability because they do not indicate how hard it is to reach a given level of performance. From a raw score of 11 to one of 12 in the example above corresponds to eight percentile points but from 18 to 19



Name STONE, DAVID JR. College LAS Class 1950 [✓ M] F Age 19 No. 423-16-565

Personnel Bureau **SUMMARY PROFILE** University of Illinois

| | Date | Test | Raw Score | %ile | Norm Group | 1 10 20 30 40 50 60 70 80 90 99 |
|---|---|---|---|---|---|---|
| General Ability | 9/46 | A.C.E. – Total | 110 | 55 | LAS | |
| | | Q | 39 | 40 | '46 | |
| | | L | 71 | 65 | | |
| Reading | | Reading Rate | 33 | 50 | " | |
| | | Total Read.Compr. | 51 | 60 | | |
| | | Math. Compr. | 19 | 40 | | |
| | | Nat. Sci. Compr. | 14 | 40 | | |
| | | Soc. Sci. Compr. | 18 | 60 | | |
| Achievement | | Total H.S. Prof. | 216 | 60 | " | |
| | | 1. Math. Total | 45 | 55 | | |
| | | 2. Nat. Sci. Total | 37 | 45 | | |
| | | 3. Soc. Sci. Total | 56 | 55 | | |
| | | 4. Engl.Mech.Total | 155 | 75 | | |
| | | 5. American Hist. | 37 | 35 | | |
| | | Composite | 326 | 60 | | |
| Special Aptitude | | Minn. Paper F. B. | | | | |
| | | Mech. Compr. | | | | |
| Personality | | H. E. Rorschach | | | | |
| Special Tests | | | | | | |

Fig. 102. Profile chart of a college student. This is one way of arranging the scores from several tests so as to present a concise picture of a student's abilities and achievements. All test scores have been converted to percentile scores based on the norms for college freshmen, and these percentile scores are graphed horizontally at the right. Usually a standard battery of tests is given to freshmen when they enter, and space is left for special tests that might be given later.

The A.C.E. is a widely used test of college aptitude in general. *Q* refers to the quantitative part of this test, and *L* refers to the linguistic part.

On the basis of this profile how would you estimate this student's chances of graduating from a liberal arts college? from an engineering college?

corresponds to only one percentile point. Yet, judging by the number of people between these limits, the range of difficulty from 18 to 19 is much greater. In this respect, and some others, standard scores are often preferred, and have been adopted, for example, by the Army and Navy in their large-scale testing programs.

Standard scores are based on the standard deviation, which is another device for describing a distribution, slightly different from the percentile device. We begin with the center of the distribution, or average, not at the bottom as in computing percentiles. And the average we use is not the median but the mean, which is the more familiar one.

Beginning with an easy example, let us say that we gave a short vocabulary test to the first 10 people we met on the street and that they got these scores: 8, 4, 5, 8, 11, 7, 7, 5, 6, 9. The first thing we have to do is get the mean of these scores. And this is done merely by adding them and dividing the total by the number of cases.

$$\begin{array}{r} 8 \\ 4 \\ 5 \\ 8 \\ 11 \\ 7 \\ 7 \\ 5 \\ 6 \\ 9 \\ \hline 70 \end{array}$$

$$70 \div 10 = 7$$

The answer is 7. Those who like to represent the steps by a formula would write

$$\text{Mean} = \frac{\text{sum of scores}}{\text{number of scores}}$$

Usually the Greek letter Σ is used for "sum of," and $X$ is used for score, and $n$ for the number of cases. Then the formula becomes

$$M = \frac{\Sigma X}{n}$$

(Now we know two averages: the median, which was explained on page 305, and the mean.)

The next step is to find the standard deviation, a very useful thing to know when we want to describe a distribution of scores. The deviation we are talking about is the deviation of each score from the mean, which we now know is 7. Let us subtract 7 from each score. $8 - 7 = 1$. We call 1 the deviation and put it below in the column headed $d$. $4 - 7 = -3$. Minus numbers are awkward to handle but not at all mysterious. $5 - 7 = -2$. And so on. For each score we get a deviation from the mean.

| $X$ | $d$ |
|---|---|
| 8 | 1 |
| 4 | −3 |
| 5 | −2 |
| 8 | 1 |
| 11 | 4 |
| 7 | 0 |
| 7 | 0 |
| 5 | −2 |
| 6 | −1 |
| 9 | 2 |

Now we want to multiply each deviation by itself, or square it. $1 \times 1 = 1$. So we write 1 opposite 8 in the column headed $d^2$, meaning $d$ squared. $-3 \times -3 = 9$. So we write 9 opposite 4 in the column headed $d^2$. And so on.

| $X$ | $d$ | $d^2$ |
|---|---|---|
| 8 | 1 | 1 |
| 4 | −3 | 9 |
| 5 | −2 | 4 |
| 8 | 1 | 1 |
| 11 | 4 | 16 |
| 7 | 0 | 0 |
| 7 | 0 | 0 |
| 5 | −2 | 4 |
| 6 | −1 | 1 |
| 9 | 2 | 4 |
|  |  | 40 |

The rest is easy. What we are after is a kind of average of these deviations. So when we have squared each deviation and put each $d^2$ in the $d^2$ column, we add all these. The sum of these is 40, which we can call the sum of the squared deviations, or $\Sigma d^2$. Since there are 10 of them and we want an average, we divide by 10, getting 4 for an answer. But we squared all the deviations, so we must "unsquare" them

or get the square root of 4, which is 2. That is all there is to it. The standard deviation, or *SD*, of this set of 10 scores is 2. In the form of an equation it is

$$SD = \sqrt{\frac{\Sigma d^2}{n}} = \sqrt{\frac{40}{10}} = 2$$

Now that we have the standard deviation, what good is it? The *standard deviation* is a measure of variation or scatter of the scores on both sides of the mean. Compare the set of 10 scores in the example above with this set: 7, 7, 5, 7, 8, 6, 8, 7, 9, 6. Which set of scores shows more scatter? (The *SD* of this set is about 1.) Would you rather teach a class with a large standard deviation of vocabulary scores or a small one? If you were selecting chorus girls, would you pick a group with a large standard deviation of heights or a small one? If you were going to a desert island with 10 people for a year, would you want a group with a large *SD* in respect to intelligence or a small *SD?* Is the *SD* of intelligence larger in a college group or a high-school group? If you go back and review the steps in computing an *SD*, you will see that when the scores are clustered close to the mean, the *SD* is small. When they are spread out, the deviations of the scores from the mean will be large and the standard deviation will therefore be large. The standard deviation gives us all this information about the scatter of the scores wrapped up in one figure. It is therefore a very useful device, along with the mean, in describing a distribution of scores.

If we are dealing with a large sample of scores and the distribution is approximately normal (see page 303), the standard deviation gives us very detailed information about the distribution. We know, for example, from tables prepared by statisticians, that in any normal distribution 34 per cent of the cases in the distribution lie between the mean and a point 1 standard deviation above the mean. For the distribution of scores on the vocabulary test given to the sample of the voting population in the United States, the mean was about 11 and the *SD* about 5. We know, therefore, that roughly 34 per cent of the population got scores between 11 and 16. Similarly 34 per cent got scores between 11 and 6. Between a score 1 standard deviation above the mean and a score 2 standard deviations above the mean, falls about 14 per cent of the distribution, and so on. If we know the mean and

standard deviation of a normal distribution, we can quickly find out how many people lie above and below any particular score, or between any two scores. (The mean IQ in the United States is 100, and the *SD* is 16. What proportion of the population get IQ's between 84 and 116? What fraction of the people have IQ's above 132?)

Now that we understand the standard deviation we can come back to standard scores, for a *standard score* is any score that is based on the standard deviation. It would be easy to convert the 10 raw scores in the example above to standard scores now that we know the standard deviation is 2. All we have to do is divide each deviation by the standard deviation.

$$1 \div 2 = 0.5, \qquad -3 \div 2 = -1.5$$

$$-2 \div 2 = -1.0, \qquad \text{and so on}$$

| *X* | *d* | *Standard Score* |
|---|---|---|
| 8 | 1 | 0.5 |
| 4 | −3 | −1.5 |
| 5 | −2 | −1.0 |
| 8 | 1 | 0.5 |
| 11 | 4 | 2.0 |
| 7 | 0 | 0 |
| 7 | 0 | 0 |
| 5 | −2 | −1.0 |
| 6 | −1 | −0.5 |
| 9 | 2 | 1.0 |

Figure 103 shows the relation between standard-deviation units obtained in this way and percentile scores.

Standard-deviation units always have a mean of 0, and they range from about −3 to +3. Converting the scores from several different tests to such standard scores lines them up on one standard frame of reference and makes them easier to evaluate. But minus scores frighten many people and they are somewhat awkward to work with, so for practical purposes they are often changed by adding some number to all scores. The Navy, for example, has converted the scores from all the tests of their Basic Test Battery to standard scores that have a mean of 50 and a standard deviation of 10. Thus nearly all scores fall somewhere between 20 and 80. The Army Air Corps has used Stanines, which are standard scores that run from 1 to 9 with a mean at 5. The famous Army General Classification Test, and many other Army

tests, were scored on a scale that had a mean of 100 and a standard deviation of 20.

To illustrate the final step in getting standard scores, let us convert our set of 10 scores to the scale the Army used, having a mean of 100 and an *SD* of 20. Our *SD* was 2. To make it 20, we must multiply the deviations by 10. A score of 8 has a deviation from 7 (the mean) of 1. $10 \times 1 = 10$. But, since we want our standard scores to have a mean of 100, we must add 100 to all these scores. $10 + 100 = 110$. A score of 4 has a deviation of $-3$. $10 \times -3 = -30$. $-30 + 100 = 70$. And so on. The column headed Army Standard Score shows what our vocabulary scores will finally look like, when they are all converted to the standard-score scale which the Army used.

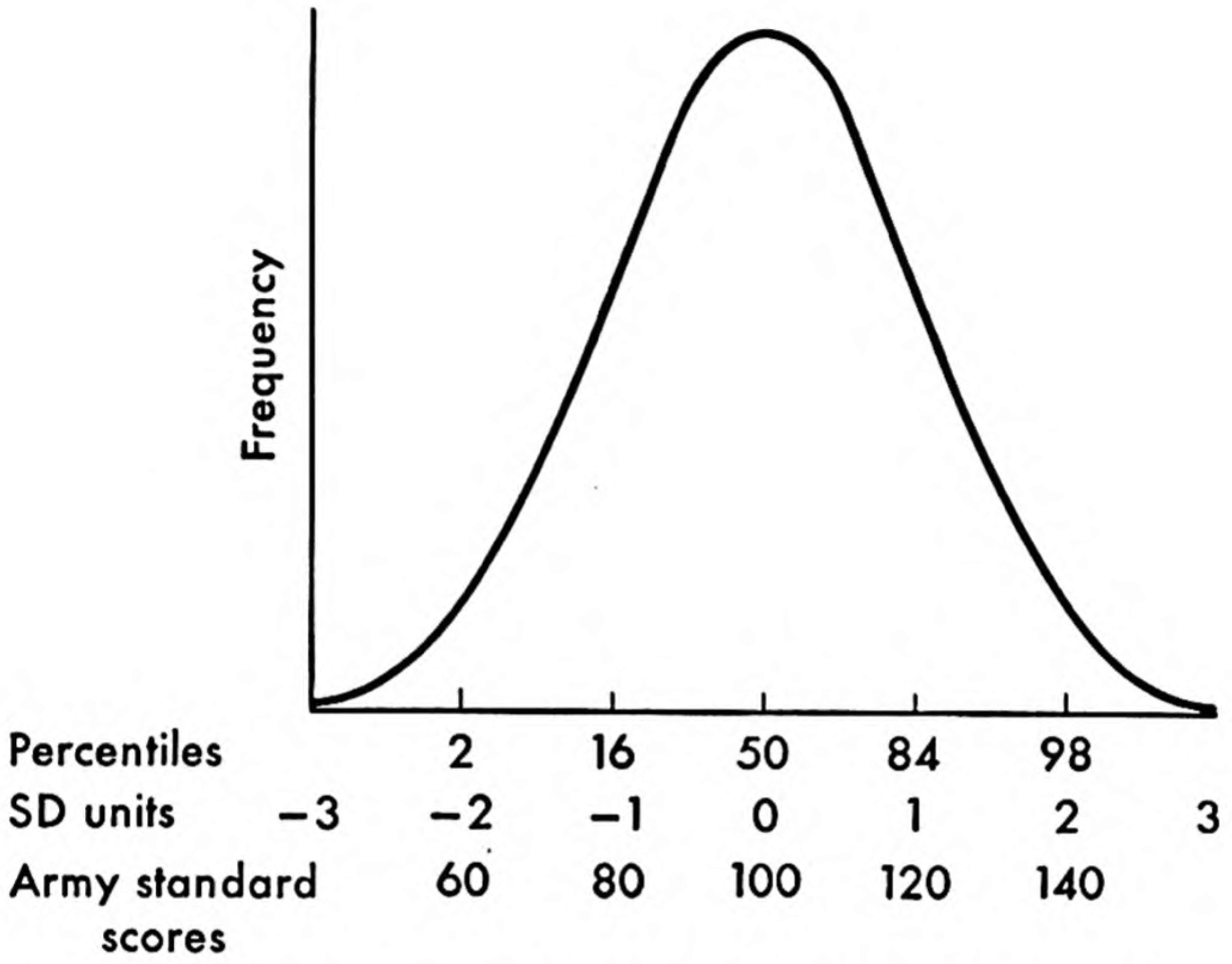


Fig. 103. Relations between percentiles, standard-deviation units, and Army standard scores.

| | | | *Army* |
|---|---|---|---|
| | | | *Standard* |
| *X* | *d* | | *Score* |
| 8 | 1 | 10 | 110 |
| 4 | −3 | −30 | 70 |
| 5 | −2 | −20 | 80 |
| 8 | 1 | 10 | 110 |
| 11 | 4 | 40 | 140 |
| 7 | 0 | 0 | 100 |
| 7 | 0 | 0 | 100 |
| 5 | −2 | −20 | 80 |
| 6 | −1 | −10 | 90 |
| 9 | 2 | 20 | 120 |

Once these calculations have been completed, we have a table of norms by which the raw score on the test can be quickly converted into an equivalent standard score. A portion of such a table, showing a few test scores for the Army General Classification Test with the equivalent standard scores, is shown below.[7]

| *Raw score* | *Standard score* | *Percentile score* |
|---|---|---|
| 103 | 140 | 98 |
| 76 | 120 | 84 |
| 64 | 110 | 69 |
| 52 | 100 | 50 |
| 41 | 90 | 31 |
| 31 | 80 | 16 |
| 11 | 60 | 2 |

It is the standard score, derived from the test score by a table like the one above, which was entered on the soldier's Qualification Card, and which the GI himself often erroneously called his IQ. The percentile scores have been computed and included in the table for comparison. One can see, for example, that about 30 per cent of the population tested received standard scores below 90 and another 30 per cent or so were above 110, the limit officially set at one time for admission to Officer Candidate School.

**The IQ.** Anyone who understands about mental ages and standard scores is prepared to encounter the IQ, that fabulous scientific concept which escaped the obscurity of the psychological laboratory a few years ago and has already established such a reputation that its name can be read throughout the American culture, from a column in a literary weekly to a wrapper on a candy bar. Its popularity, as a way of indicating a person's intelligence, is not undeserved. It has a certain constancy that the mental age, on which it is based, does not have, for the mental age, or MA, though it has its worth as an expression of the intellectual status of a growing boy or girl, has the disadvantage that it changes from one year to the next as the youngster matures, and this makes it hard to compare youngsters of different ages. If Leo has a mental age of ten and Marvin one of twelve, Marvin

is obviously more intelligent than Leo. But, if Leo is nine years old and Marvin is thirteen, in a relative sense Leo is the more intelligent, since he is above average for his age while Marvin is below average. This relative intelligence—relative, that is, to one's age—turns out to be a more constant value than the MA, and therefore a more widely useful index of the amount of intelligence at any one time. A boy who has an MA of eleven when he is ten is above average for his age, 10 per cent above, one might say. Another boy who has an MA of only nine when he is ten has only 90 per cent of average intelligence for his age.

There are very clear advantages to computing this ratio and using it as a measure of brightness or relative intelligence. (Economists use the same argument when they compare relative prices of butter and toothpicks in 1948 by figuring the ratio of each commodity to prices in 1935.) The boy whose MA was eleven when he was ten gets an intelligence ratio or quotient of 1.10. The "slow" boy has one of 0.90. (For the benefit of those who are sensitive about decimals, it is conventional to multiply these quotients by 100, making them 110 and 90, respectively.) The formula reads

$$IQ = \frac{MA}{CA} \times 100$$

In this formula CA means chronological age, or age according to the calendar, while MA means the mental-age score. Dividing intellectual level, expressed as mental age, by the time required to reach that level is the same as dividing the number of miles driven in a car by the time taken in driving them. It yields an index of rate of progress.

More than that, a person who has traveled the intellectual highway rapidly the first 6 years of his life will travel at approximately the same rapid rate for the next 6 years. Under ordinary conditions the rate of intellectual advancement can be projected into the future, for the age range between five and fifteen at least. One can test a youngster at age seven, for example, and predict what level of intellectual maturity he will reach 5 years later with fair accuracy. A picture of the growth of intelligence is shown in Fig. 104. The middle line represents the mental development of that hypothetical typical child with an IQ of 100, who grows one mental year every calendar year, and who consequently has an MA of eight when he is eight, an MA of

nine when he is nine, and so on. A child with an IQ of 110, growing at a faster rate, will have an MA of about five and a half when he is five and about eleven when he is ten. His growth curve slants upward more steeply than the average, while the curve for an IQ of 90 rises more slowly. About half the children in the country have IQ's between these limits of 90 and 110.

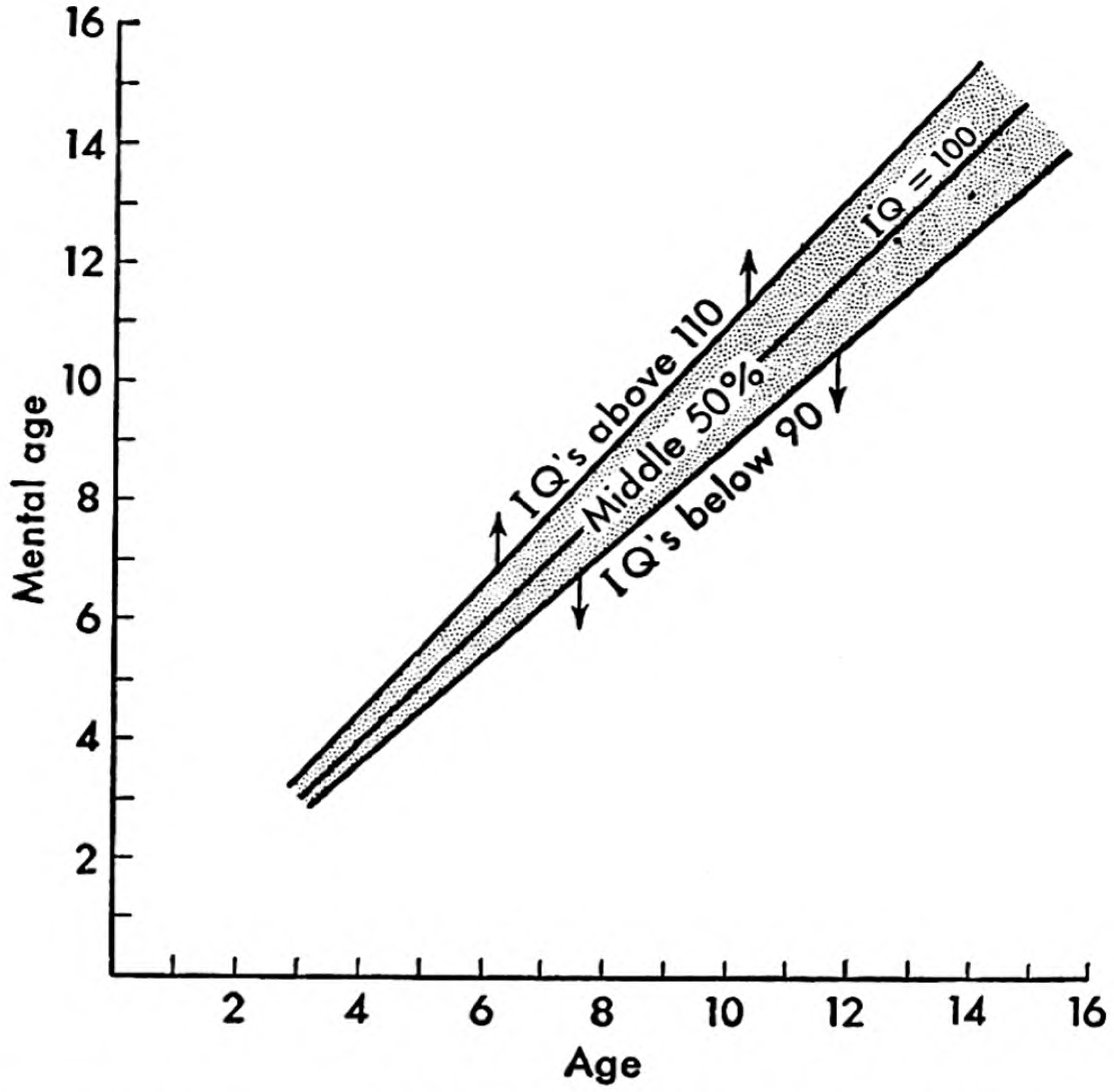


Fig. 104. Age, mental age, and IQ. The average child at 5 has a mental age of 5. At 10 he has a mental age of 10. At 13 this hypothetical average child would have a mental age of 13. His mental age would increase one year each year. His IQ would be 100 and his intellectual development could be shown by the middle line. Children with IQ's of 90 develop somewhat more slowly and reach a mental age of 9 at age 10. Those with IQ's of 110 develop somewhat faster and reach a mental age of 11 at age 10. About 50 per cent of the children have IQ's between 90 and 110 and the other 50 per cent are above and below these limits. For an actual case see Fig. 105.

It is this relatively constant characteristic of the IQ and the predictability it affords for the intangibles of a person's future which has conferred upon it the fame and notoriety it now enjoys. But the experts have never expected such a high degree of constancy as the amateurs. In the first place, the score obtained from even the most reliable intelligence test has an error of 3 per cent or more (see page

295). And the tests given to five-year-olds are not exactly the same as those given to ten-year-olds. Furthermore, the effect of intellectual stimulation in the child's environment, or lack of it, cannot be overlooked.

The question of the "constancy of the IQ," as it is called, is one of intense interest to anxious parents (of bright children and of dull ones), to educators, and to students of the old heredity-environment problem. In order to get the facts straight, several psychologists have kept tab on a number of children, testing them year after year, in order to observe just what happens.

One pioneer in the testing of intelligence, Dr. J. E. W. Wallin[8] of Wilmington, Delaware, started back around 1925, when intelligence tests were new, to test two girls regularly every 6 months, and continued for over 13 years. The older girl, whom Wallin called A, was first tested when she was three, at which time she had a mental age of three years and two months. So her IQ was 106. On the next test, 6 months later, her IQ was 114. On the next 108, then 115, then 120, then 118, and 119. On the next, when she was six and a half, her IQ was 113. And so it goes. When she was fourteen, her mental age was sixteen years, eight months, and her IQ, 118. Her progress is shown in Fig. 105, where it can be compared with the average rate of maturation. The lowest IQ in these 11 years was 106 and the highest was 123, a spread of 17 IQ points. The greatest change in a half year was 10 points. For the other girl the picture is similar. This may be taken as typical. This amount of fluctuation, this irregularity in the growth curve, is what one may expect from year to year under ordinary conditions. Most of the fluctuation, perhaps all of it in this case, is due simply to the error of measurement of the IQ. The most accurate IQ is, of course, the average of these 23 IQ's taken during the growing period, which average is 115. If this is considered as the "correct" IQ, the largest fluctuations are eight or nine points above and below this figure. The average fluctuation or "inconstancy" is a little less than four IQ points or about 3 per cent.

In this case, then, the changes in IQ could be the result of the small variations in the accuracy of the measuring instruments, IQ remaining perfectly constant. But the intellectual soil in which this child grew up was quite uniform; when the child's surroundings change markedly, rather large changes in IQ sometimes occur, an important point

which will be considered later in this chapter in connection with the heredity-environment problem. It is still true that an expert psychological examiner can measure a child's IQ at age five and predict 10 years ahead with an average error of less than 20 per cent. That is better than the weather man can do, predicting 10 days ahead.

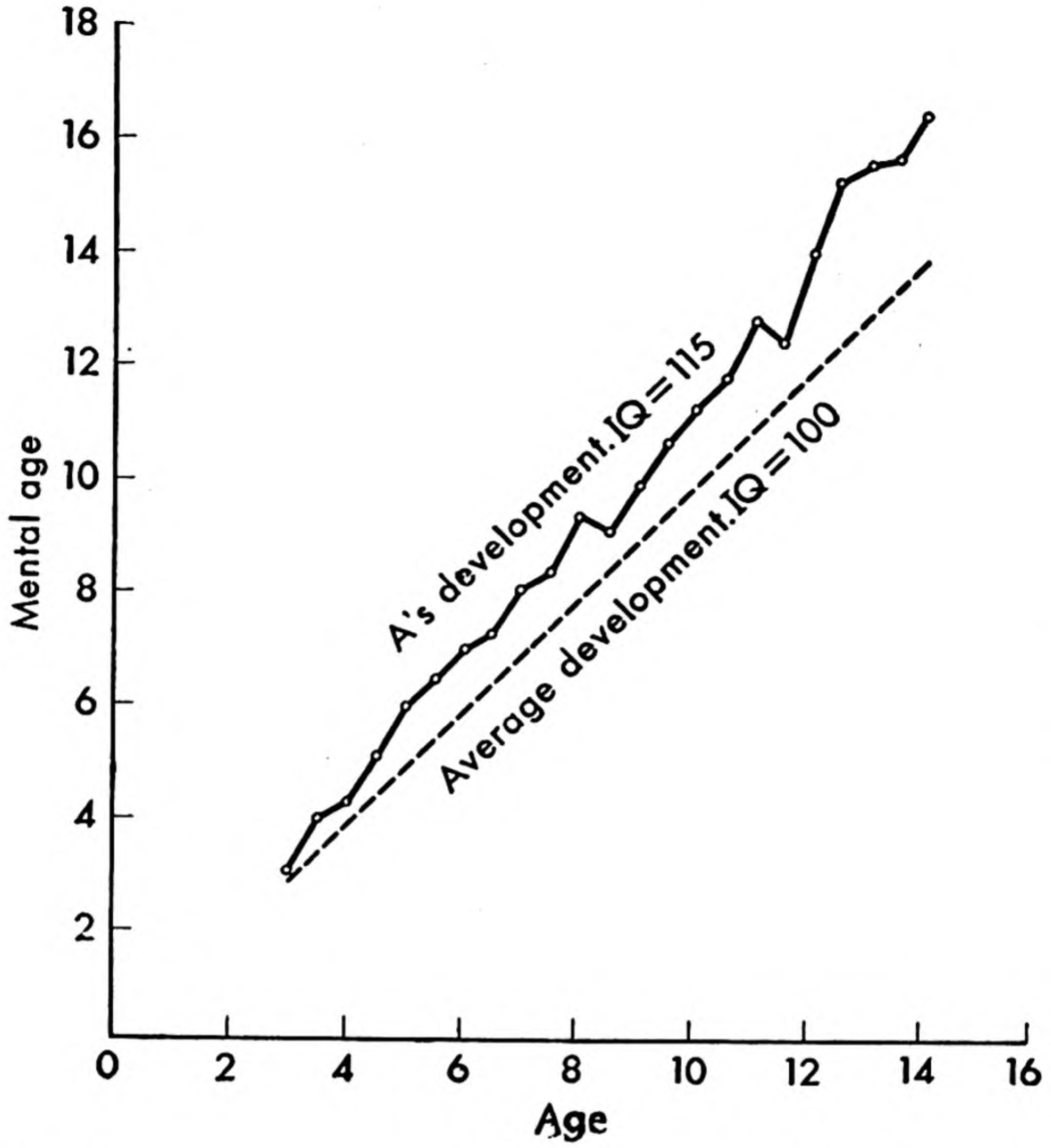


Fig. 105. This girl was tested regularly for many years. At 3 her mental age was 3 years 2 months; so her IQ was 106. Six months later her IQ was 114. And so on. The average of the 23 IQ's is 115. Her intellectual development from 3 to 14, as shown by the heavy line, may be compared with average intellectual development, as shown by the broken line.

The fluctuations in A's IQ may be taken as typical of what occurs when a child grows up in a fairly constant environment. If the environment changes considerably, in some psychologically important way, more change in IQ may be expected. (*Data from Wallin.*[8])

Psychologists are interested not only in the intelligence of particular boys and girls, but in auditing the intellectual resources of the nation as a whole. Terman and Merrill,[9] of Stanford University, tested a representative cross section of the American-born white children of the

United States when they constructed their latest revision of the Binet tests, so that the manner in which intelligence is distributed throughout the land is now quite well understood. About 3 per cent, for example, will have IQ's below 70, and about half will test between 90 and 110. A condensed table of these percentages is shown below, and a graph is shown in Fig. 106.

*Percentages of IQ's in the Native-born White Population of the United States*

| *IQ* | *Per Cent* |
|---|---|
| Above 130 | 3 |
| 110–129 | 24 |
| 90–109 | 46 |
| 70– 89 | 24 |
| Below 70 | 3 |

The fact of great scientific importance is that approximately the same percentages of IQ's are found in these several IQ brackets whether four-year-old children are tested or ten-year-olds. At all ages the standard deviation is roughly 16. Since the tests used at these different ages are quite different, the similarity in range of ability is remarkable. The consequence is that the IQ for growing children is not only a

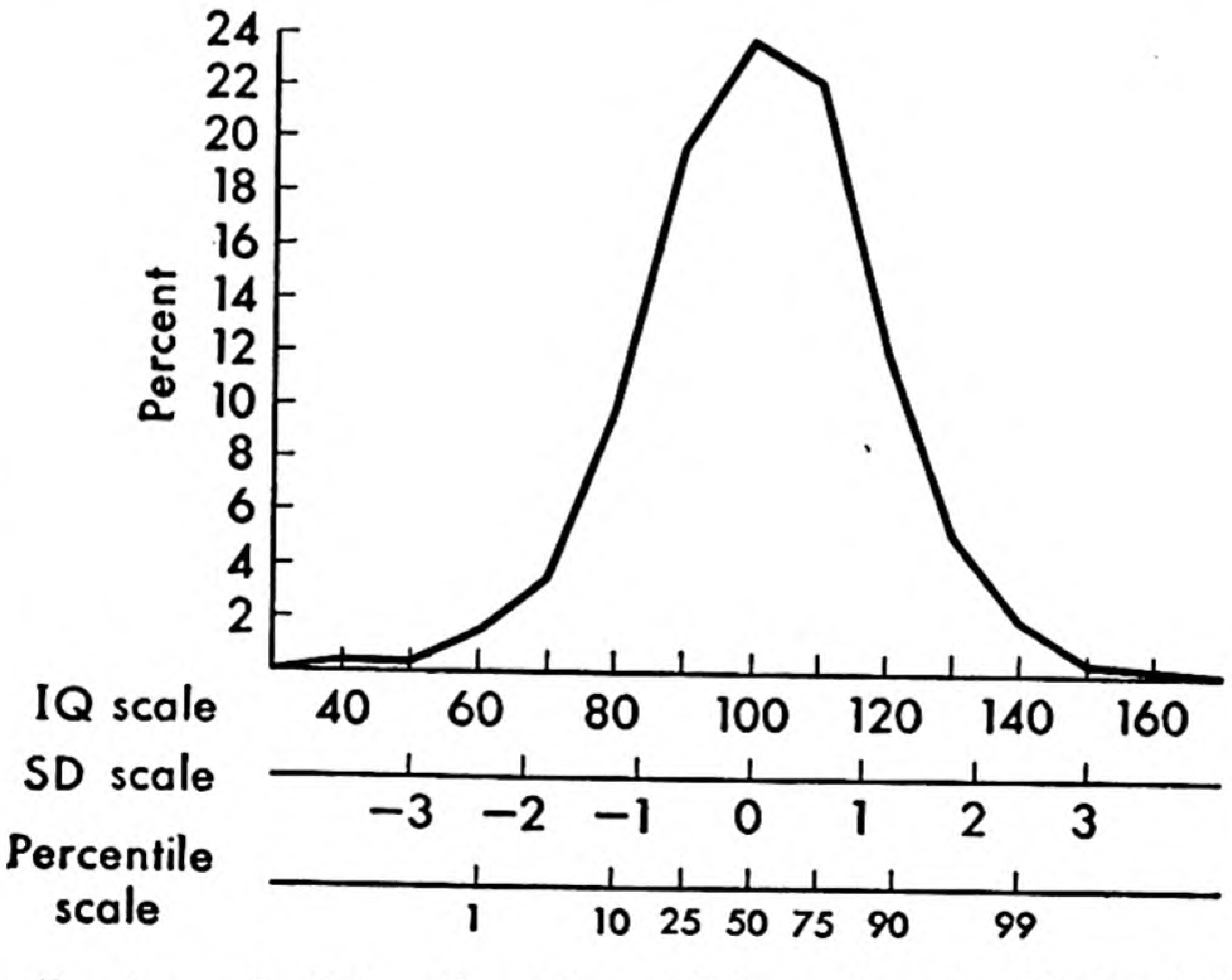


Fig. 106. Distribution of IQ's of white children in the United States. (*From Terman and Merrill, Measuring intelligence, Houghton Mifflin, 1937, p. 37. By permission of the authors and publisher.*)

quotient, obtained by dividing MA by CA and thus indicating rate of intellectual progress, it is also a standard score, which supplies a standard frame of reference within which any youngster's intelligence can be evaluated without regard to his age. The curve shown in Fig. 106 portrays a normal distribution (see page 303), and a child who is 1 *SD* above the mean at five will also be approximately 1 *SD* above the mean when he is seven.

*IQ for adults.* When all these facts are put together, it is apparent that the IQ is a very handy addition to the scientific tool box, at least between the ages of three and thirteen, when intellectual maturation is definite and regular, and good mental-age norms are available. *But how about IQ's for adults?* A few paragraphs above it was stated that mental ages for adults are fictitious. Obviously there is no point in dividing MA by CA if the MA is meaningless, so we come to the conclusion that adult IQ is a myth, and adult intelligence can only be expressed in terms of percentiles or standard scores.

But we have seen that the IQ for children is already a standard score, with a mean of 100 and an *SD* of 16. So the most convenient scale to use for expressing adult intelligence would be one that would yield scores with a mean of 100 and an *SD* of 16. Though they do not know the technical terms, like "mean" and "standard deviation," most educated people now know that IQ's range from almost 0 up to 200, that the average is 100, that an IQ below 60 suggests mental deficiency, and that IQ's above 140 are extraordinary. Instead of asking people to learn a new scoring system, it would be convenient to take the system that has become familiar from years of testing children and carry it over to the testing of adults.

With these considerations in mind David Wechsler,[10] psychologist at Bellevue Hospital in New York, when he constructed an intelligence test for adults about 10 years ago, decided to score it in terms of IQ. He tested a large number of adults, intended to be a representative sample of the adults of the United States, in order to determine the distribution of the scores, then made up a table of norms for converting their raw scores into standard scores with a mean of 100 and an *SD* of 16. These he called IQ's. The raw scores decline after age twenty-five, as we shall soon see; but the norms are made up so that the mean IQ for any age is 100.

That is all there is to it. Above age fifteen an IQ is merely a standard score that locates an individual in reference to the scores of others of his age and assumes the same range of ability as the range of IQ's for growing children. An adult intelligence quotient of 90 is not a quotient. Nothing is divided by anything. But it has roughly the same meaning as the more orthodox IQ, *i.e.*, about a quarter of the population scores below this point, and three-quarters above. Whether this new IQ will be as stable for adults as the old-fashioned IQ is for children is a question which will be answered as time goes on and more data are accumulated.

*AGCT and IQ.* Since the Army General Classification Test is an intelligence test, expressed in terms of standard scores, and IQ is also a standard score, what is the relation between the two? This question cannot be answered with a high degree of accuracy because the IQ applies to a representative sample of American-born white children while the AGCT was standardized on soldiers. If we are willing to assume that the two samples are similar, however, we can convert from one scoring system to the other quite simply. Both scales have a mean of 100, but AGCT scores have an *SD* of 20 while IQ's have an *SD* of 16. To convert an AGCT score to an IQ, it is only necessary to subtract 100 from it, take four-fifths of this difference, and add 100. The formula is

$$\mathrm{IQ} = (\mathrm{AGCT} - 100)\tfrac{4}{5} + 100$$

The table below will make the translation even easier.

| *AGCT score* | *Approximate IQ* | *AGCT score* | *Approximate IQ* |
|---|---|---|---|
| 150 | 140 | 90 | 92 |
| 140 | 132 | 80 | 84 |
| 130 | 124 | 70 | 76 |
| 120 | 116 | 60 | 68 |
| 110 | 108 | 50 | 60 |
| 100 | 100 | | |

An IQ obtained in this way from an AGCT score will be a reasonably adequate facsimile—with an error of four points or so in the mid-

dle range and probably more near the extremes—to the IQ for adults, which is after all only another kind of standard score.

## ABILITIES AND THEIR ANALYSIS

Up to this point we have been discussing how tests for measuring people's abilities are constructed, and the scores that are used for expressing different amounts of these abilities. Let us now see how the abilities themselves are analyzed and classified, and how some abilities are related to others. The question of the relationship between abilities is a very important one for modern psychology. Offhand, the ability to work arithmetic problems would appear to be similar or related to the ability to work algebra problems. And verbal ability would seem to be different from, or unrelated to, either. But how do we know how much one ability is related to another?

The answer is simple in principle: If the people who score high on Test A also score high on Test B, and vice versa, then the ability tested by A must overlap the ability tested by B. All we have to do is give both Test A and Test B to a large number of people and compare their scores. The measure of relationship is the *correlation coefficient.*

Suppose we know someone who is good in arithmetic and also has a large vocabulary. Does that prove that arithmetic and vocabulary are related abilities? No. Because we could probably find someone else who is above average in arithmetic and below average in vocabulary. (We could "prove" anything we wish if we selected only those cases that fit.) In order to measure the correlation properly we must test a large representative sample of the people we are interested in, without selecting any special cases.

Let us say that we gave a short arithmetic test to the same people to whom we gave a vocabulary test a few pages back, and that their scores were, in the same order: 12, 8, 11, 14, 9, 11, 8, 7, 5, 15. To get the correlation coefficient we need to know the standard deviation of both sets of scores. We already know that the *SD* of the vocabulary scores is 2, and we can compute the *SD* of the arithmetic scores in the same way, as shown on the next page. The sum of the ten scores is 100. Dividing this by 10 we get a mean of 10.

| Y | d | $d^2$ |
|---|---|---|
| 12 | 2 | 4 |
| 8 | −2 | 4 |
| 11 | 1 | 1 |
| 14 | 4 | 16 |
| 9 | −1 | 1 |
| 11 | 1 | 1 |
| 8 | −2 | 4 |
| 7 | −3 | 9 |
| 5 | −5 | 25 |
| 15 | 5 | 25 |
| 10)100 | | 90 |
| 10 | | |

$$\sqrt{\frac{90}{10}} = 3$$

The deviation of 12 from 10 is 2. The deviation of 8 from 10 is −2. And so on. These deviations are squared, and the squared deviations are added up. The sum is 90. Divide this by the number of cases, which is 10, and get 9. The square root of 9 is 3. And 3 is the *SD* of the arithmetic scores. We are now half done.

The correlation coefficient is usually designated as *r*, and the formula for it is

$$r = \frac{\text{the sum of the cross products}}{n \times \text{one } SD \times \text{the other } SD}$$

What we need next is the sum of the cross products. "Cross product" here means the product of one deviation by the other.

| X | d | Y | d | *Cross Product or d × d* |
|---|---|---|---|---|
| 8 | 1 | 12 | 2 | 2 |
| 4 | −3 | 8 | −2 | 6 |
| 5 | −2 | 11 | 1 | −2 |
| 8 | 1 | 14 | 4 | 4 |
| 11 | 4 | 9 | −1 | −4 |
| 7 | 0 | 11 | 1 | 0 |
| 7 | 0 | 8 | −2 | 0 |
| 5 | −2 | 7 | −3 | 6 |
| 6 | −1 | 5 | −5 | 5 |
| 9 | 2 | 15 | 5 | 10 |
| | | | | 27 |

$$r = \frac{27}{10 \times 2 \times 3} = \frac{27}{60} = .45$$

The vocabulary score of 8, for the first person, has a deviation from its mean of 1. The arithmetic score of 12, for the same person, has a deviation from its mean of 2. And 1 times 2 is 2. So 2 is the cross product. −3 times −2 equals 6, which is the next cross product. And so on. The sum of the cross products is 27, if we watch our minus signs when we add. That is the numerator of the formula for the correlation coefficient. The denominator is 10 times 2 times 3. So the final answer is .45, the correlation coefficient.

Now that we have the correlation coefficient, what does it mean? In the first place it is a fraction, a decimal fraction. The highest possible correlation coefficient is 1, which would indicate that the two sets of scores are perfectly correlated. Everyone who is above average on one test would be above average, and relatively just as far above average, on the other. If a person who is high on one test is just as likely to be low as high on the other, the correlation coefficient, when properly calculated, would come out as 0, indicating no relationship between the two sets of scores. The coefficients range between these limits of 0 and 1. Of course the relationship may be an inverse or negative relationship. If the people who are high on one test are low on the other, the correlation coefficient would come out with a minus sign in front of it, for example, −.45. Negative correlations between abilities are very rare. People who are above average in one ability are likely to be above average in the other, if the two abilities are related at all. When we come to personality traits, in the next chapter, we shall run into negative correlations, however. The correlation between fluctuations in the price of cotton over a 50-year period and fluctuations in the number of lynchings per year, mentioned in Chap. 3, is a negative one, −.65. As the price of cotton goes up, the number of lynchings comes down, and vice versa.

An easy way to become familiar with correlation coefficients is to guess at a few. (Answers are at the end of this chapter.)

1. What would you estimate the correlation between height and weight in a class of college freshmen?
2. Estimate the correlation between high-school grades and college grades.
3. Between intelligence and college grades.
4. Between scores on a vocabulary test and scores on a test of reading comprehension.

5. Between height and mechanical ability.

6. Between head size and intelligence.

7. Between one good vocabulary test and another.

8. Between a vocabulary test scored by counting the number right and another, which is scored by counting the errors.

9. Between number of children in a family and the average intelligence of these children.

**Reliability and validity again.** Since the correlation coefficient is a measure of relationship, it is widely used to indicate reliability and validity. For measuring the internal consistency (see page 295) of a test, scores for 100 people on both halves of the test are correlated, just as the vocabulary and arithmetic scores were correlated in the example above. For measuring day-to-day consistency, the scores from one form of the test are correlated with the scores from another form of the same test given a week later. A correlation coefficient calculated in either of these ways is called a *reliability coefficient.*

A reliability coefficient of .90 is high enough for most purposes. If the scores are to be used for any purpose that requires high accuracy, as in recommending that a child be committed to a school for the feeble-minded, the reliability coefficient should be above .94.

The validity of a test that is used in predicting success in a job may be calculated in several ways, one of which makes use of the correlation coefficient. Scores on the test are correlated with later ratings of success on the job, and this measure of relationship goes by the name of *validity coefficient.* Validity coefficients seldom rise above .60, and a coefficient of .30 may indicate that the test is saving the employer large amounts of money. (More about validity coefficients at the end of this chapter.)

## INTELLIGENCE

The most important ability of all goes by the name of intelligence. So we shall first try to find out what intelligence is and does, then compare different groups of people in intelligence, and see what intelligence tests have contributed to the old heredity-environment controversy.

**The nature of intelligence.** Orderly thinkers would like to have their science proceed in a well-planned fashion, along straight lines.

First something is defined, then it is measured. But the career of "intelligence" illustrates the reverse sequence, which is equally frequent in the history of scientific progress. While theories and definitions of intelligence were spinning, the measurement of intelligence was gradually being perfected. It is not at all uncommon in the history of thought that a vaguely defined, nontechnical term is taken from popular or scholarly language by the technicians, sharpened, and then redefined in accordance with the operations by which it is measured. (Other examples are magnetism, fatigue, cost of living, and public opinion.) In a common-sense way intelligence can be defined as the ability to solve the general run of human problems, to adjust to new situations, in short, the ability to think. The miniature problems or tasks that appear in tests designed to measure intelligence must satisfy this rough-and-ready definition first of all. Intelligence tests never ask people to chin themselves, for example. With the nature of intelligence thus marked out in a preliminary way, the precise meaning of the term comes from the analysis of intelligence tests in operation and from correlations between different intellectual abilities.

Eleven items, of the kinds found on contemporary intelligence tests, are printed on page 325 as examples. Other common types are the digit-span test, described on page 94, perceptual tests, as depicted on pages 130 to 132, tests of following directions, putting blocks together to form a specified model, detection of absurdities in stories and in pictures, induction of a principle, and solving simple puzzles. Some of the best of these cannot be printed on paper but must be given orally by a trained examiner to one subject at a time. As Galton put it, the procedure is to assay the human mind by sinking shafts at critical points.

At first impression the score a person gets on an intelligence test composed of 80 variegated problems like these would represent a composite or sum of the abilities necessary for success along 80 different lines. But many years of statistical analysis of intelligence-test questions have shown that the score is more than a mere composite. Performance on a good intelligence test is not just the sum of an arbitrary assortment of talents, because many of these talents occur in combination. A person who gets one of these little tasks right is more likely than not to get the others right. There is a correlation or overlapping between whatever ability it takes to do one kind of task and whatever it takes to do the others. The case is something like height and weight.

1. If Monday were called Wednesday, and Tuesday were called Thursday, what would Thursday be called? ............

2. *This* is to *that* as *now* is to which of these? (Underline the correct word.)

know then ever thus there

3. Complete the series: 4, 14, 5, 12, 7, 10, 10, 8, ...., ....

4. If you were standing on your head facing the North Pole, which direction would be at your right? ............

5. Rearrange these words so that they form a sentence, then write on the dotted line whether the sentence is true or false.

EARS ALL HAVE ANIMALS TWO ............

6. Underline the word which does not belong with the others.

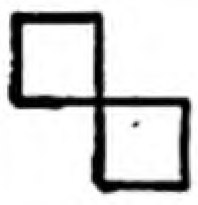
aunt boy cousin daughter parent

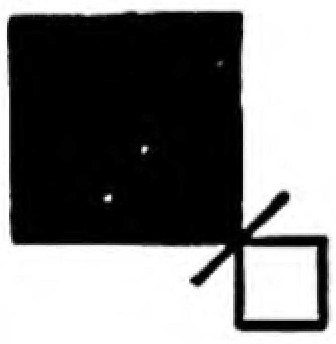
7. Underline the number which does not belong with the others.

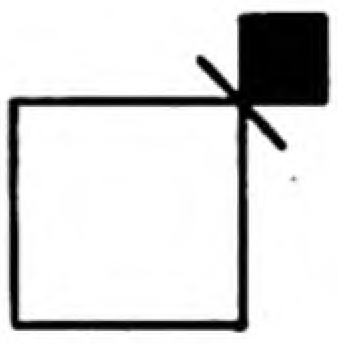
6084 4 426 7 51

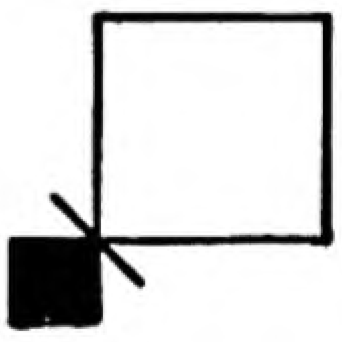
8. Man is to niece as (?) is to nephew.

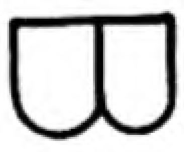
woman women son daughter sister

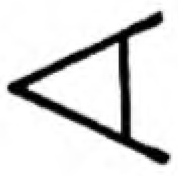
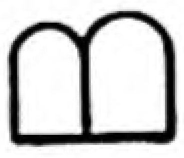
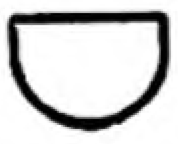
9.  is to  as  is to

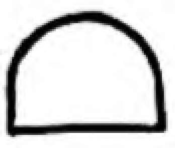






10.  is to  as  is to



11.  is to  as I is to

smells hears knows listens sees

Fig. 107. A few typical intelligence-test items.

People who are tall are, by and large, likely to be heavy. Height and weight, then, have something in common. Figure 108 gives a graphical representation of three tests, each of which has something in common with the others and something which is specific to itself. This common overlapping factor, which operates so helpfully throughout the diverse problems of the intelligence tests and the even more diverse problems of daily life, is called *general intelligence*, or simply intelligence.

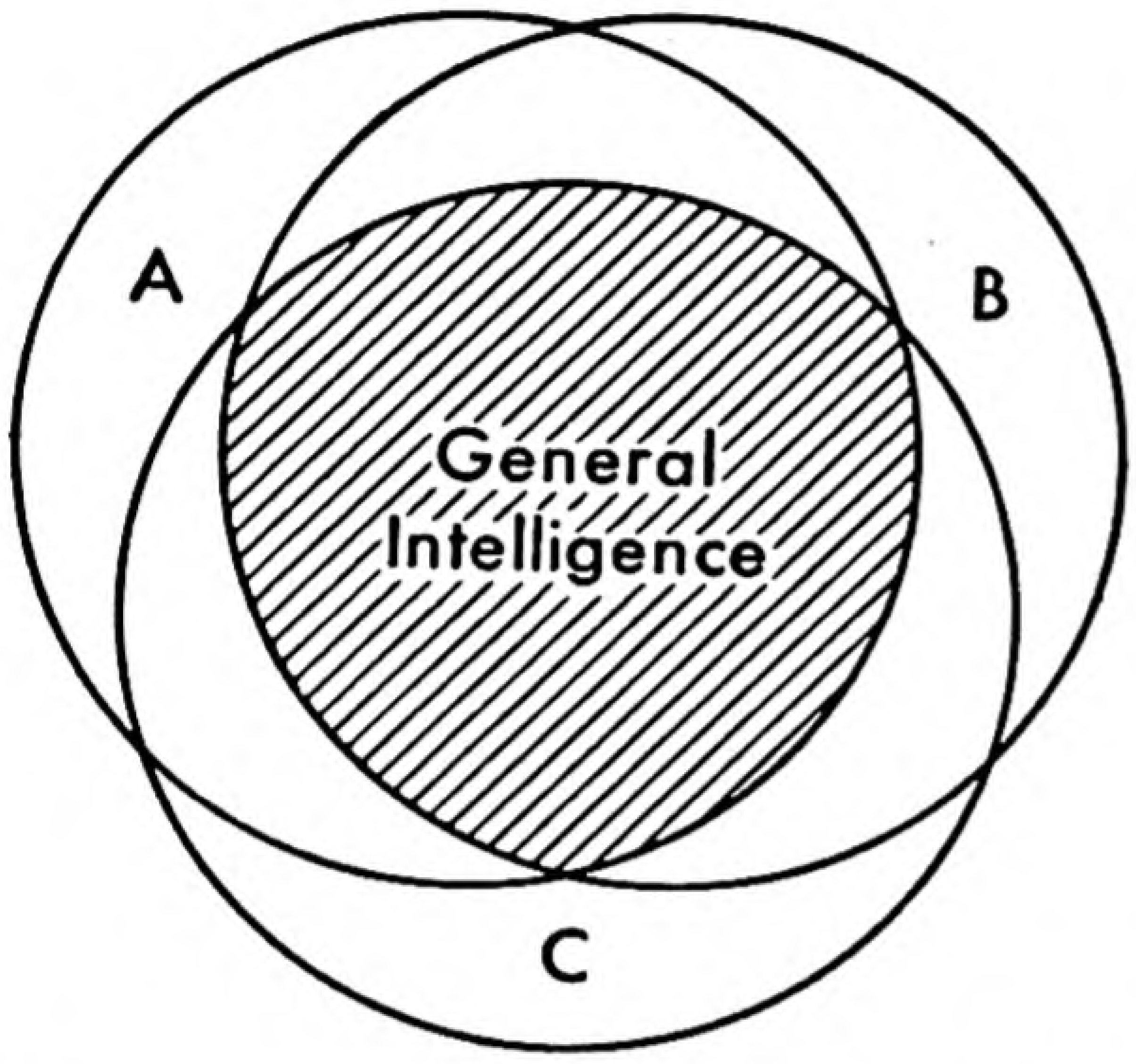


Fig. 108. General intelligence is the overlapping ability tested by a variety of different tests, such as *A*, *B*, and *C*. This diagram represents the approximate amount of overlap between the tests usually given to children. Compare with Fig. 110.

In many of the modern tests of intelligence this general factor has been deliberately emphasized by throwing out test questions that are too specific, *i.e.*, which do not correlate well with the general factor. This method of purifying a test by eliminating those items which test something else is responsible for the high accuracy of the best of the present-day tests. People who score high on one good intelligence test, for example, will score high on another, even though the two may not look at all alike, and one may have been manufactured in Los Angeles and the other in London.

Just as it is possible to emphasize general ability, it is possible to reduce the general factor and emphasize special abilities. The composite of abilities necessary for success on a wide variety of problems can be broken up, if need be, into a number of separate abilities, more or less independent of each other, and tests of these different intellectual factors furnish detailed analytical information about a person's capacities and weaknesses.[11] The largest single factor in general intelligence, research has shown, is *verbal ability*, the ability to manipulate words and the abstract relationships between them. All intelligence tests include a large percentage of verbal questions, like Nos. 2, 5, 6, and 8 of the sample test on page 325. It is altogether right that they do, because most high-power abstract thinking is carried on by means of high-power abstract words. Another important ability, which overlaps verbal ability to some extent, is *numerical ability*, illustrated by Nos.

3 and 7. People high in this ability are good at figures, and like to work number problems. Still another intellectual trait is *spatial ability*, the sort of facility which is required for success on Nos. 4, 9, and 10. Tests built recently, like those worked up for the Army and Navy during the Second World War, include these three kinds of material in approximately equal amounts.

But intellectual nourishment can be sliced in many ways. One could stress the operations performed and therefore divide intelligence into tests of such functions as memory, attention, perception, and judgment. And there are other possibilities now being explored. Ability to perform a large number of easy tasks quickly is not the same as the level of difficulty reached when given unlimited time. In fact, the similarity between a speed test that answers the question "how fast" and one which answers the question "how high a level" is no greater than the similarity between the 220-yard dash and the high jump. Even verbal ability has been split into two factors: (1) a passive knowledge of the meanings of words, demonstrated by recognition of synonyms and antonyms, and (2) verbal fluency (see page 225), which is a facility in naming words that rhyme with "hare" or fruits that begin with *a*.

All such capacities can be included in one omnibus test, which would therefore be called a test of general all-round intelligence, but for some purposes it is more to the point to measure these diverse talents separately. Anyone who is familiar with the variety of jobs in modern civilization can understand why one or two of these separate tests could be more suitable in selecting employees than a composite of them all. Engineers, for example, need plenty of spatial ability, and tests of spatial relations are in actual use in engineering schools, but their need for verbal ability is not so great as a lawyer's. Numerical ability is a necessity for navigators, but only in minimal amount for pilots. The two profiles in Fig. 109 show how the abilities of two people are broken down and evaluated analytically.

Though we can always divide people's abilities into a general ability or intelligence and a number of more specific intellectual abilities, the general ability is particularly important to children but less important to adults. As the nervous system matures, intelligence differentiates or breaks up into fairly distinct aptitudes. Adults are more specialized than children. Among grade-school boys, for example, the correlation

between the verbal factor and the number factor has been found to be about .80, while among college men it runs around .30.[12] Or, to put it another way, when nine-year-old children are given a wide range of tests, the contribution of general intelligence to the answers is about 30 per cent. But when twelve-year-old children are given the same tests, the importance of general intelligence drops to about 15 per cent. Figure 108 on page 326 can be taken as representing the overlap among abilities during childhood, while Fig. 110 represents the situation for adults.

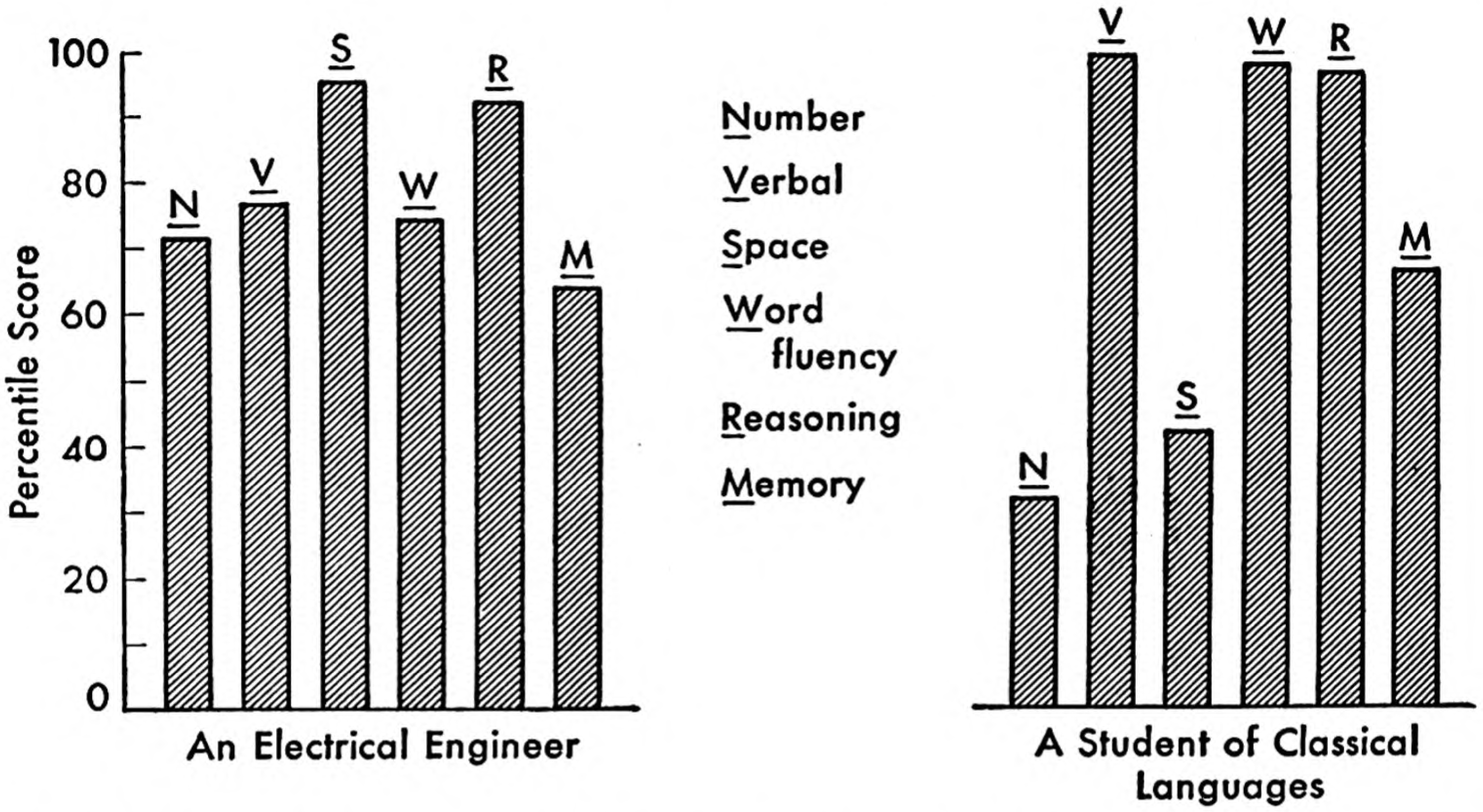


Fig. 109. The abilities of two people analyzed into six different factors. The number, verbal, and space abilities are described in the text. Word fluency means the ability to think of words rapidly. (Name seven words that rhyme with "moon.") The ability here called reasoning is involved in finding a principle in series of letters. (What letter should follow this series? a b t c d u e f v g h –) Memory here means the ability to memorize names. (*From Thurstone and Thurstone, Chicago tests of primary mental abilities. Science Research Associates, 1943.*)

This specialization of intelligence seems to be complete early in life because the general factor is just as prominent in the correlations[13] for tests given to adults between 20 and 34 (average intercorrelation .43) as between 35 and 49 (average intercorrelation .47). So it is probably a result of maturation rather than training.

*What, then, do we mean by intelligence?* We can begin by saying that it is the ability to solve problems. Now, as we learned in the chapter on thought and judgment, problem solving depends on many

different factors, information at hand, attention, ability to form concepts, experience, knowledge of common errors, persistence, fluency, and so on. The construction of a test of intelligence may begin with a miscellaneous assortment of tasks for testing all these but soon narrows down to those which hang together or overlap, *i.e.*, those which correlate with each other. Musical and artistic abilities are excluded, for example, because these are special talents, which do not tie in statistically with the other, more general abilities. Also the advantages of special training, such as would be indicated by a knowledge of words used by fishermen, are eliminated in the construction. The information that is a part of the general culture, however, like knowing who is President of the United States, is within the experience of any alert adult and is actually used on one test for adults. Not to know the answer to this question indicates, not lack of opportunity, but lack of ability. Intelligence is, therefore, the most general ability, the ability that operates in the widest variety of problems. From examination of the questions that test this general ability most adequately (see Fig. 107), we can see that the essence of it is the capacity for abstract thought, for comprehending and manipulating subtle numerical relations, spatial relations, and the like, and, above all, verbal relations or concepts. As we learned from our analysis of thinking, intricate problems involving numerical and spatial relations are often solved by the aid of verbal relations. And that is one reason why verbal or conceptual ability is the most important component of general intelligence.

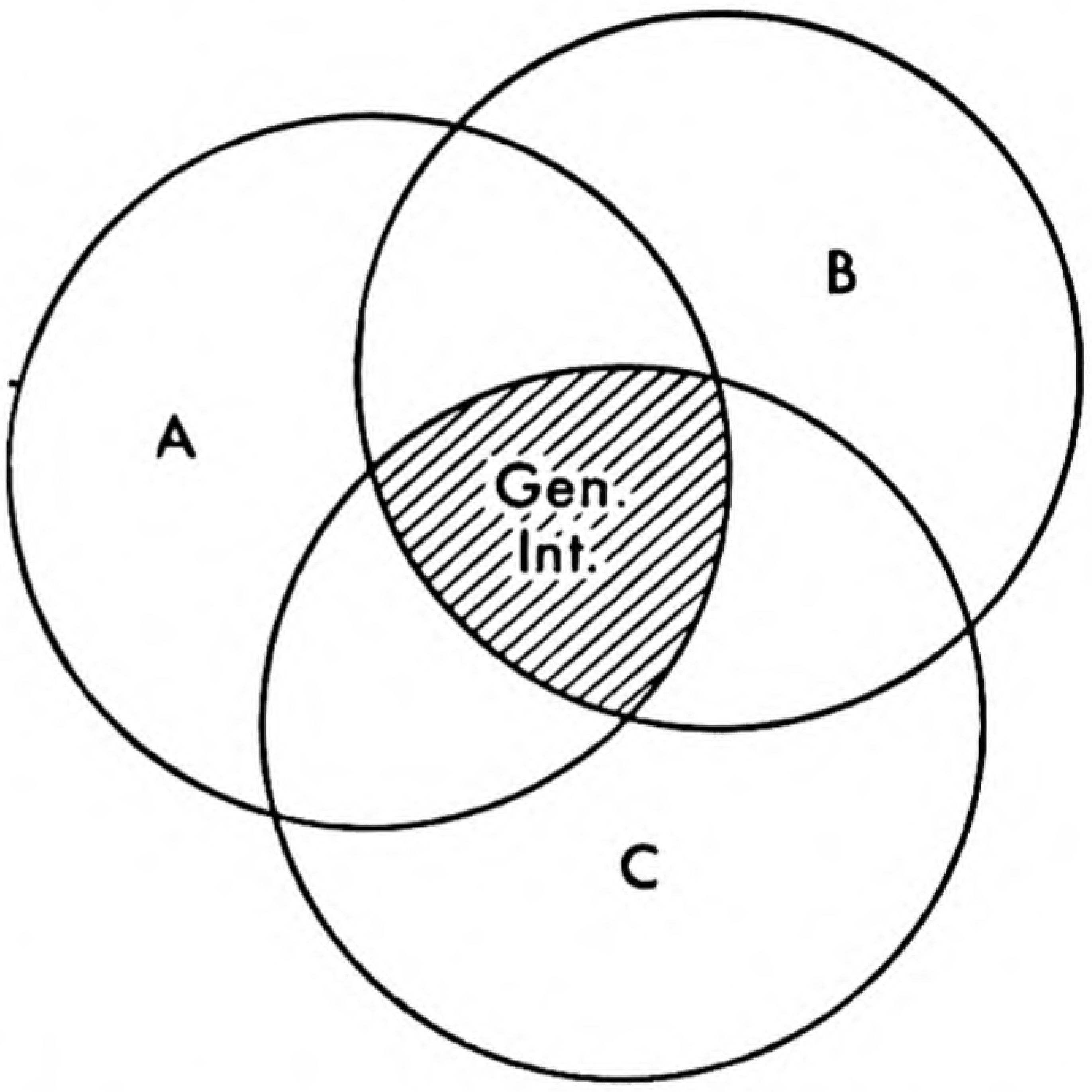


Fig. 110. General intelligence in adults. Compare this diagram, which represents the approximate overlap between tests commonly given to adults, with Fig. 108.

Intelligence has been defined at times as speed of learning. But we have seen in the chapter on learning that such a definition can no longer be accepted.

We began our analysis of abilities by excluding motivational and emotional factors, and in practice these variables are minimized by

administering the tests under optimum conditions, with high motivation and low emotionality. But the concept of general intelligence may be revised, like the concept of space, as research advances. If emotional control can be measured with high reliability and can be shown to overlap well with other abilities, it may alter the notion of general ability. Persistence is another likely candidate for admission to the inner circle. At present such dynamic factors are separated from abilities and considered as personality variables in the next chapter.

***Age and ability.*** The fact that children become more intelligent as they advance toward the prime of life is obvious, but what is not so obvious is the decline in mental ability after the prime. When the Bellevue-Wechsler intelligence test was standardized, large numbers of people from seven to seventy were tested, and the highest scores were obtained by those between twenty and twenty-five. As Fig. 111 shows, there is a rapid rise up to age fifteen and a slow steady decrease after twenty-five. We cannot be sure, of course, that the average man of sixty today was as high when he was twenty as the average man of twenty is today. But, if we look at the situation as it is today, the average person of forty is about even with the level of the thirteen-year-olds. The typical old man or woman of sixty, looking forward to a pension, does about as well on these tests as the average youngster of twelve.

It is equally interesting to note that the top quarter at age sixty are above the average for age fifty. The brightest people decline least; the dullest decline most. The scatter, or standard deviation of ability, increases slightly from twenty to sixty, so it is true that children are more alike than their grandparents.

The capacity for extraordinary creative achievement decreases along with general intelligence. Prof. Harvey Lehman,[14, 15, 16] of Ohio State University, becoming interested in this problem about 15 years ago, searched biographies and special histories of the arts and sciences for records of the ages at which artists, writers, scientists, inventors, and philosophers turned out their best work. The peak age for great poetry, for example, was between twenty-five and thirty. The peaks for chemistry, physics, and practical inventions fall between thirty and thirty-five. Masterpieces of painting and short-story writing and greatest achievements in mathematics and philosophy come most often between thirty-five and forty. Of the many fields Lehman investi-

gated, only one, astronomy, gave evidence of peak accomplishment beyond forty. Figures 112 and 113 indicate the frequency of great productions in two fields, and from Fig. 113 one can see that the quality of a philosopher's output usually falls off faster than the quantity. This is true in other fields as well as philosophy. In fact much of the

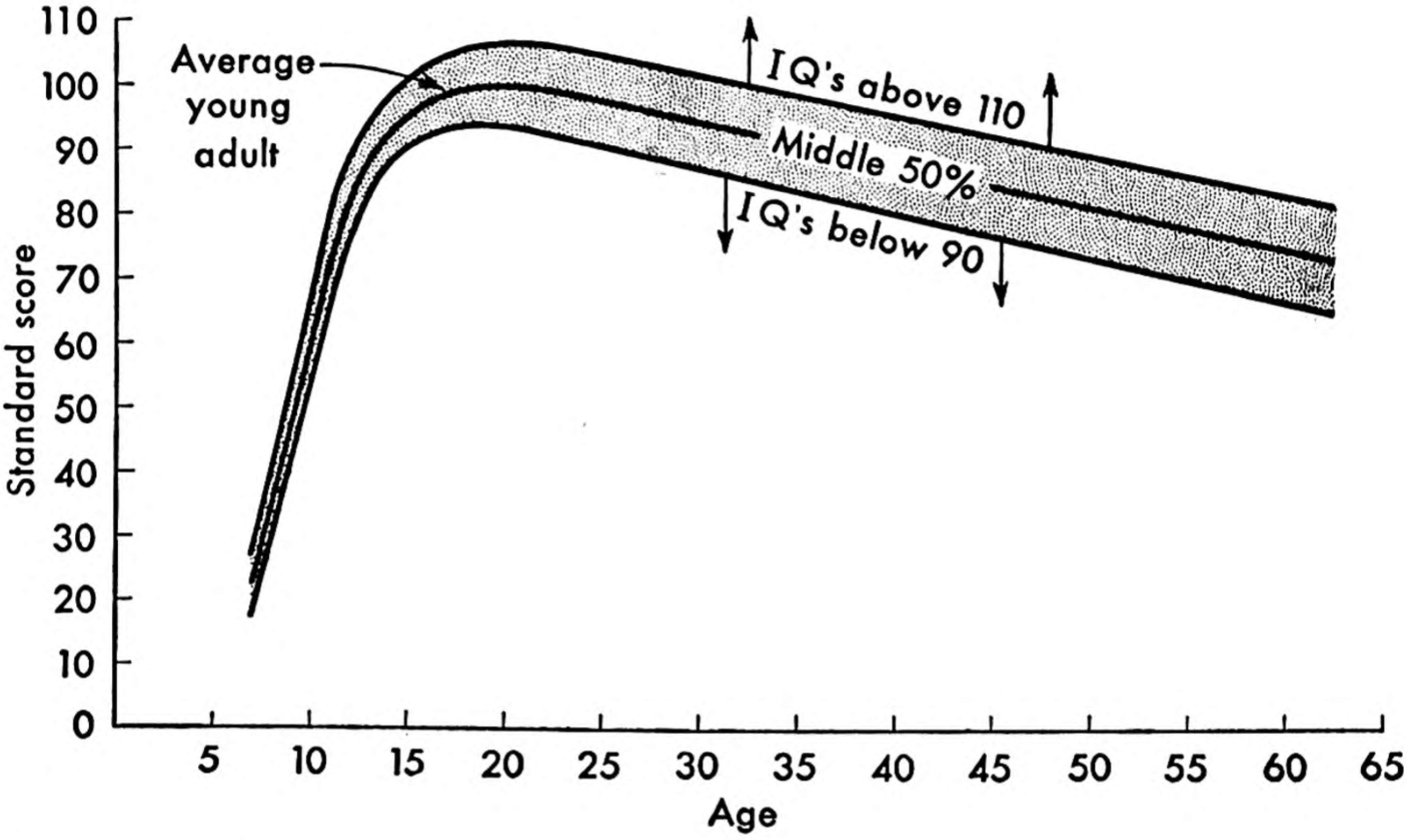


Fig. 111. Adult intelligence. The middle line represents average score on the Bellevue-Wechsler intelligence test for many people of various ages. There is a rapid increase up to age 15 and a slow decline after 25. The scoring system is arranged so that average IQ is 100 through the period of decline just as it is through the growing period. Furthermore, the scoring system is arranged so that 50 per cent will get IQ's between 90 and 110, just as in Fig. 104.

PROBLEM: Why do we not have a curve for an adult corresponding to Fig. 105 for a growing girl?

*(Modified from Fig. 2 of Wechsler, The measurement of adult intelligence, Williams & Wilkins, 1944. By permission of the author and publisher.)*

work done by great thinkers in their later years is merely an elaboration or continuation of the brilliant ideas of their youth.

The causes of this downward slope in intellectual function are, in the main, the same as the causes of physical deterioration. A curve showing increase and decrease in the weight of the brain would follow approximately the same course year by year as the curve for intelligence. There is little doubt that intelligence depends upon a brain in good condition, and that the functioning of the brain is impeded by

inadequate circulation as well as by the presence of certain chemical products of age. To be added to the physical changes are the psychological effects of cumulative experience (see the sections on creative thought in Chap. 8). It is a matter of simple arithmetic that, as a person's past experiences consolidate into congenial patterns in his nervous system, new experiences exert proportionately less weight.

Fig. 112. Age and creative achievement. Study of 60 histories of art disclosed that 650 oil paintings were mentioned at least twice. The age of each artist when he painted each picture is also given by the histories. From these facts the above curve was drawn, showing that more of these masterpieces were painted when the artist was between 35 and 40 than at any other 5-year period. Similar curves for other fields of creative accomplishment look much like this one, with the peak somewhere between 25 and 40. Note also that an appreciable number of masterpieces were painted before 25 and after 70. (*From Lehman: 1942. Psychol. Rev.,* 49, *27.*)

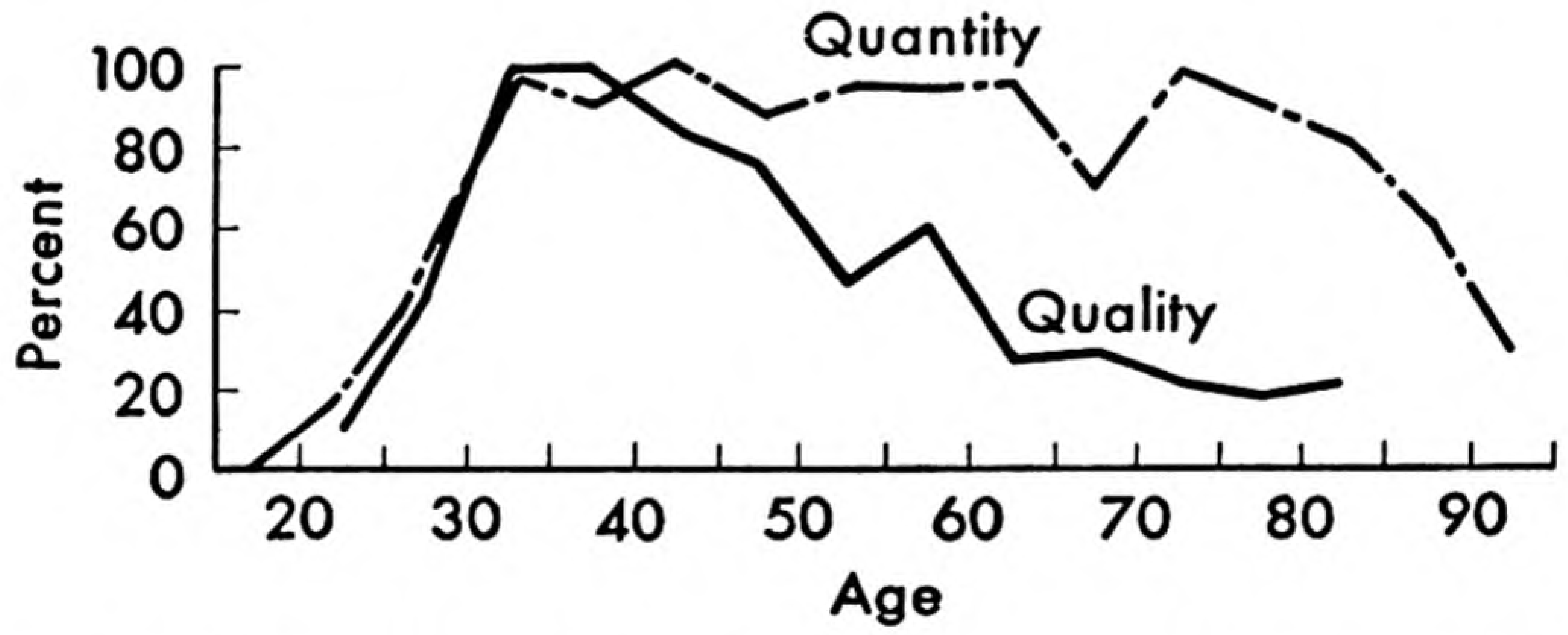


Fig. 113. Quantity and quality of creative output at different ages. The solid line shows the ages at which 182 famous philosophers wrote (or first published) their *one best* treatise, *i.e.,* the one most frequently mentioned in the histories of philosophy. The broken line was constructed by tabulating the ages at which *all* the philosophical works of these 182 philosophers were written (or first published). (*From Lehman and Gamertsfelder: 1942. Psychol. Rev.,* 49, *331.*)

The happenings of any one day will necessarily have less effect on a man who has passed through 50 years, of 365 days each, than on a man of twenty. Young men and women are more likely to put forth new

ideas, both good and bad, and to be receptive to the unorthodox ideas of others, than older people—for the same reason that a channel grooved by a spring freshet is less resistant to change than one well established by the weathers of the years.

This drop in intelligence and creativeness with age is of more than theoretical interest. As everyone now knows, the population of the United States and of most other Western nations is becoming older, both because people live longer than their grandparents did and because they have fewer children. The next step in the argument is clear. If intelligence declines after twenty-five, as the evidence indicates, average intelligence in the nation must be declining. In 1940 the median age of adults, taking all over twenty as adults, was 41. In 1900 it was 37; in 1870 when adolescent America was adjusting to the impact of science, the strains of expansion, and democratic upheavals, median age was 35½. It is easy to compute, from the statistics behind Fig. 111, that average mental ability in 1870 was equivalent to a level a little above that of youngsters of 14. In 1900 it had dropped to a little below 14, and in 1940 the average was about 13½, if this line of reasoning is correct. As our population continues to grow older, and all the evidence indicates that it will, a continued downward trend can be expected. It is true that the drop in 70 years is small. It is also true that we do not have far to go.

It is possible for optimistic observers of this picture to find some less discouraging signs in this picture. We shall still have leadership, for the spread in ability is great at all ages. And, to be sure, the standard intelligence tests measure general ability rather than special talents or the fruits of special experience. Furthermore, educational techniques are improving all the time, so it is possible that the coming generations of children may be taught the best of the adult store of knowledge and skill without being robbed of their youthful originality. It is in time of crisis, when large numbers of citizens have to work with new tools and techniques on entirely strange assignments, when the stresses and strains of historical changes require new, perhaps revolutionary, adjustments in social attitudes and points of view on the part of both leaders and followers, that the nation's loss of its youthful adaptiveness will become apparent.

Man's many abilities, unlike the parts of the "one-hoss shay," do not all age simultaneously. Older men and women are handicapped

on speed tests and on tests that require them to learn new things in a new way, but when the score is earned by an accumulation of experience, as on an information test or a vocabulary test, they do almost as well as their younger colleagues. Among the electorate, according to the nationwide survey of Thorndike and Gallup,[17] men and women between twenty and thirty knew about 11 words on a 20-word vocabulary test, while those over sixty knew 10. The curves of Fig. 114, taken from Wechsler's research, show the course of two tests that "hold up" with age and two that do not. The information test and the comprehension test, which are affected only slightly by age, are made up of questions such as "Who invented the steamboat?" and "Why should everyone vote?" The other two tests depend upon the ability to learn new things rapidly. The block-design test requires the subject to reproduce designs the examiner has made with colored blocks. Substitution is a kind of clerical test, which involves writing arbitrary symbols in place of numbers according to a code. The downward slope in the curves for these two tests is typical of what happens to the performance of oldsters when new adjustments must be made under pressure of time.

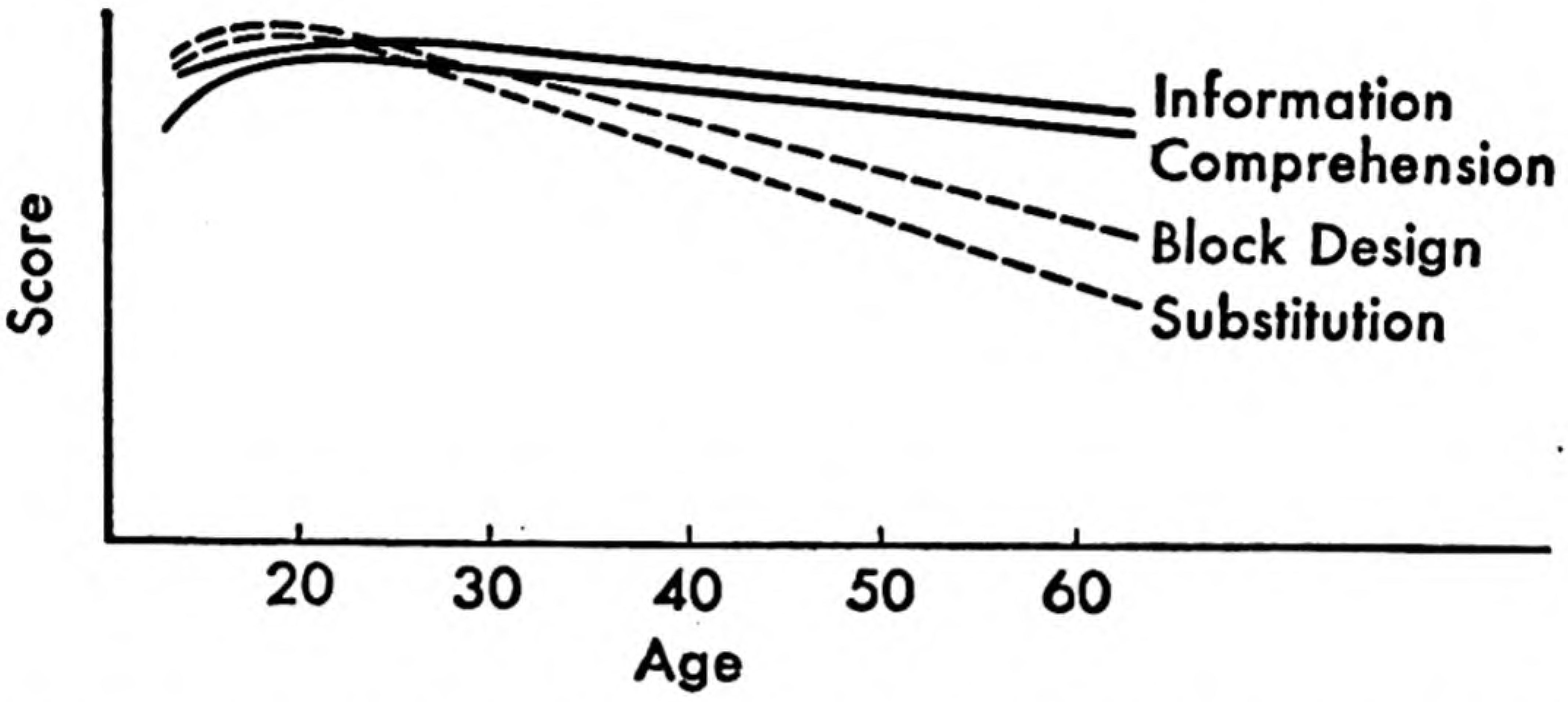


Fig. 114. Differential decline in ability with age. Questions requiring information and comprehension are answered about as well by the old as by the young. Tasks requiring new learning are harder for the older people, especially if speed is demanded. The tests are described in the text. *(From Figs. 4a and 4b of Wechsler, The measurement of adult intelligence, Williams & Wilkins, 1944. By permission of the author and publisher.)*

*Deterioration.* Psychiatrists and psychologists working with mental cases have long wanted a measure of pathological mental deterioration, in order to check on the course of a dementia or a prolonged illness, and to detect whether the illness has affected the patient's intellectual functioning. An ordinary intelligence-test score is not

diagnostic, because it has to be compared with a similar score obtained before the illness, and such a score is usually not available. To solve this problem, an ingenious technique for estimating intellectual deterioration on the basis of the facts shown in the age curves above has been developed by clinical psychologists. They use tests of vocabulary, information, and comprehension, which "hold up" well with age, as measures of the patient's original level of intellectual capacity, and compare the scores on these with the scores on tests that measure present level of functioning, such as block design, substitution, digit span, and problems in finding new relationships, illustrated by Nos. 2, 3, 8, 9, and 10 of Fig. 107. When the present level of mental performance is unusually far below the original level, deterioration must have occurred. Such abnormal deterioration occurs in insanities due to ageing of the circulation of the brain, in some kinds of epilepsy, and in schizophrenia, a chronic dementia that begins in early life. In all kinds of mental illness patients who have deteriorated least have the best chances for recovery.

**Group differences.** One of the most popular spare-time activities of human beings is to talk about other human beings. Before psychological tests were invented, the only comparisons that could be made were made on the basis of personal experience, every man for himself. Such an impressionistic method enables anyone to stack the cards and back up his prejudices or his employment policies, and to gather material for "polite" conversation. The correct method requires, of course, that a representative sample of the groups be tested and compared, not merely a few outstanding examples. Modern psychological tests permit a fairly exact, unbiased approach to the old questions about group differences, and while the results to date are not of impressive quantity and are limited chiefly to intelligence, a few of the conclusions have tremendous national significance. There are two distinct, though related, questions: (1) What is the difference between the two groups, between men and women, for instance? (2) What are the causes of this difference?

*Sex differences.* Comparing boys and girls, or men and women, in general intelligence, no one has ever found a difference of any significance. In verbal ability girls surpass boys by a trifle at high-school age and adult women are slightly superior to adult men. During the school years boys are ahead of girls in number ability, and this is

probably true of adults also, though the difference must be small. As to the various mechanical abilities, boys and men are definitely superior to girls and women in comprehension of mechanical principles ("What is the thing to do when a doorbell won't ring?"), and slightly superior in perception of spatial relations, but the sexes are about equal in dexterity with the hands. Girls and women are definitely better than boys and men at all ages on tests of clerical ability that require checking letters and numbers.[18]

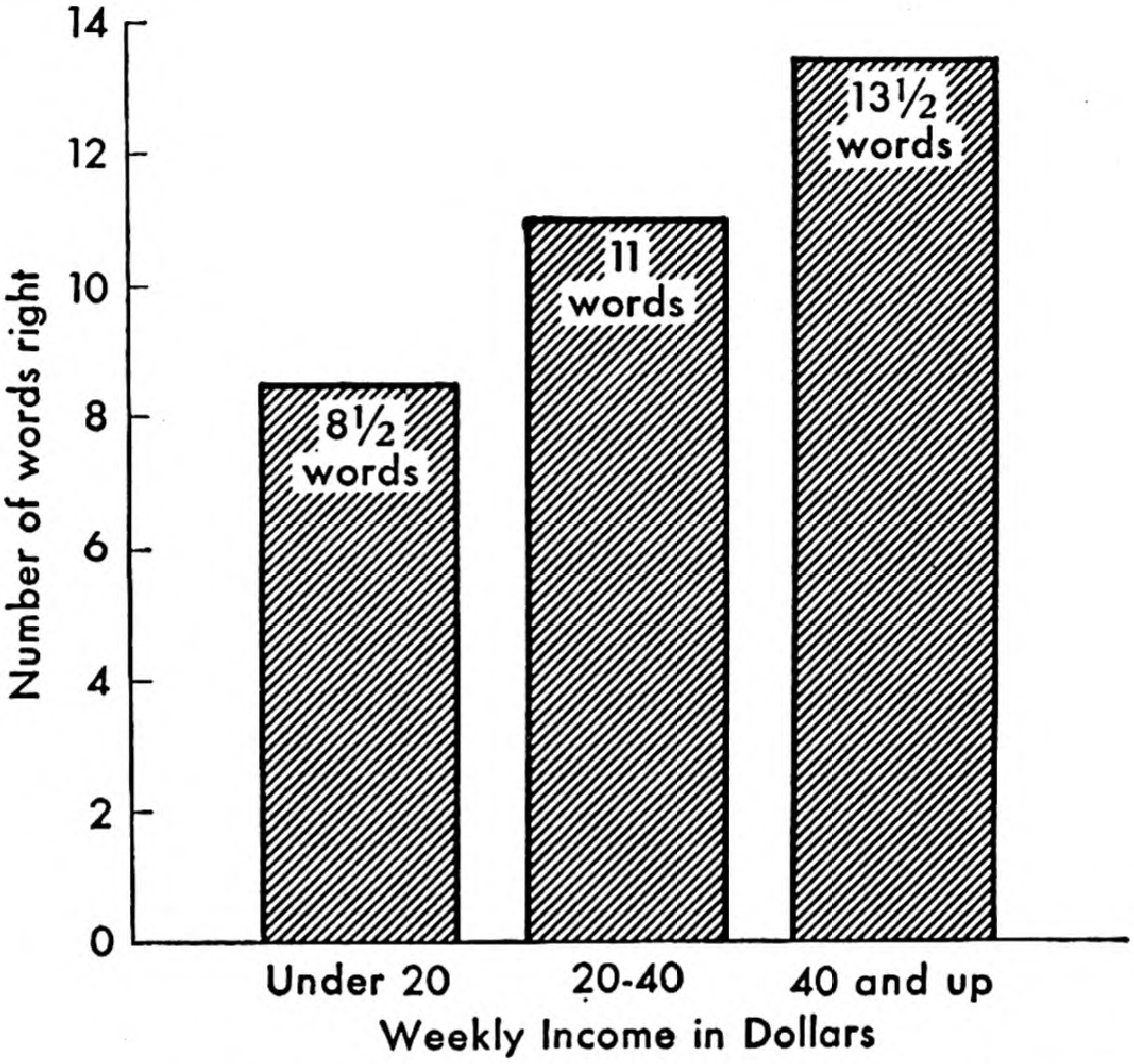


Fig. 115. Income and vocabulary level of American adults. A vocabulary test of 20 words was given to a cross section of the voting population of the United States in 1943 and the results broken down by income groups. High and low scores were made by people in all three groups but there are clear-cut differences in the averages. (*Data from Thorndike and Gallup.*[20])

In achievement, the men have done much better than the women. There are many more men than women in *Who's Who.* Many more marble men are sitting on marble horses in public parks. Men hold more responsible positions in business, industry, and government, get higher pay, and have covered more pages in the history books. Women psychologists, for example, make 20 to 40 per cent less money than men.[19] The fields in which women come closest to men are the literary and dramatic arts.

These differences between men and women could be hereditary biological differences, or they could be entirely due to different environmental forces, more encouragement of boys to learn mechanical things, more pressure on men for worldly success, and more opportunity to attain success. Certainly the environmental pressure accounts for a large share of the difference, but no one can say that it does or does not account for all of it.

*Socioeconomic differences.* Although this division of the people according to sex discloses only small differences in intelligence, a breakdown along economic lines is much more striking. The survey of a cross section of the voting population of the nation by Thorndike and Gallup [20] indicated a regular rise in verbal ability as the interviewers went into the higher income brackets. The average number of words correct, out of a test of 20 words, by people in the low-, middle-, and high-income groups is portrayed in Fig. 115.

There are large group differences also when people are divided up according to the jobs they work at. Tests given over a period of many years, on both sides of the Atlantic and the Pacific, to both military and civilian populations, all agree in ranking at the top the men in professional, managerial, and the higher clerical positions. Day laborers and farm hands are at the bottom. The table below gives the most recent estimates for intelligence in seven principal occupational groups.[21]

*Intelligence in Seven Occupational Groups*

| *Occupation* | *Average IQ* | |
|---|---|---|
| | *Adults* | *Children* |
| Professional | 125 | 116 |
| Semiprofessional and managerial | 117 | 112 |
| Clerical, skilled trades, retail business | 108 | 107 |
| Rural owners, farmers | 96 | 96 |
| Semiskilled, minor clerical, minor business | 104 | 104 |
| Slightly skilled | 97 | 98 |
| Day laborers, rural and urban | 96 | 96 |

When children are grouped according to the occupations of their fathers, the averages of these groups do not deviate so much from the national average as their fathers do. This illustrates a familiar principle of genetics. If we begin with very tall fathers, we will find that their children are not so tall as they are. Likewise, if we begin with very short fathers, we shall find that their children are not so short. The hereditary endowment of the father is usually not so extremely high, or extremely low, as his body and his achievement indicate, and this heredity is diluted, before it affects the child, by that of the wife, who is usually less extreme than the father we began with.

Lest the overlapping between these occupational groups be overlooked, a graph has been prepared (Fig. 116) for a comparison of two extreme groups. Harrell and Harrell[22] tracked down the AGCT scores of 18,782 white enlisted men of the Army Air Forces Air Service Command and classified them according to the occupations they were engaged in, 74 different occupations, before the President sent his greetings. In respect to intelligence the accountants were at the top of the pile with an average AGCT standard score of 128, which corresponds roughly to an IQ of 123. Teamsters were at the bottom with an average of 88, equivalent to an IQ of 90. Nevertheless, 5 per cent of the teamsters made scores of 120 or better. Although the typical accountant in the Air Forces was considerably brighter than the typical teamster, there was an appreciable number of individual accountants who were lower than some teamsters. The overlapping (shown by the shaded area in the graph) is much larger when any other two occupational groups in the Air Forces are compared.

The psychological reasons for this intellectual hierarchy of occupations are not hard to understand. In fact, the principles underlying this state of affairs make a neat study in the social dynamics of the structure of a modern industrial society. First in importance comes the great desirability of the jobs near the top of this ladder. Greater social prestige (see page 232), larger incomes, and pleasanter working conditions, all combine to surround the top jobs in this land of opportunity with incandescent allure, visible from all points below. Next in importance comes the ability required to meet the standards of the most desirable occupations, for it takes more ability, of a sort, to learn the techniques of a lawyer or an accountant than those of a

farm hand, and more to learn those of a skilled mechanic than those of a mechanic's helper. The standards are set by various examining and licensing boards, made up of established members of the guild or profession, and these agencies push the standards down and up in accordance with the board members' ideas of the job requirements, their anticipation of the needs of society, and their fear of unemployment. Such mechanisms of selection, once in operation, reinforce the prestige and income of the top jobs, thus consolidating the occupational stratification and spreading people out along the occupational ladder according to their abilities. The reasons for the overlapping are the well-known inequalities in educational opportunities, differences between people in susceptibility to the prestige drive, and many

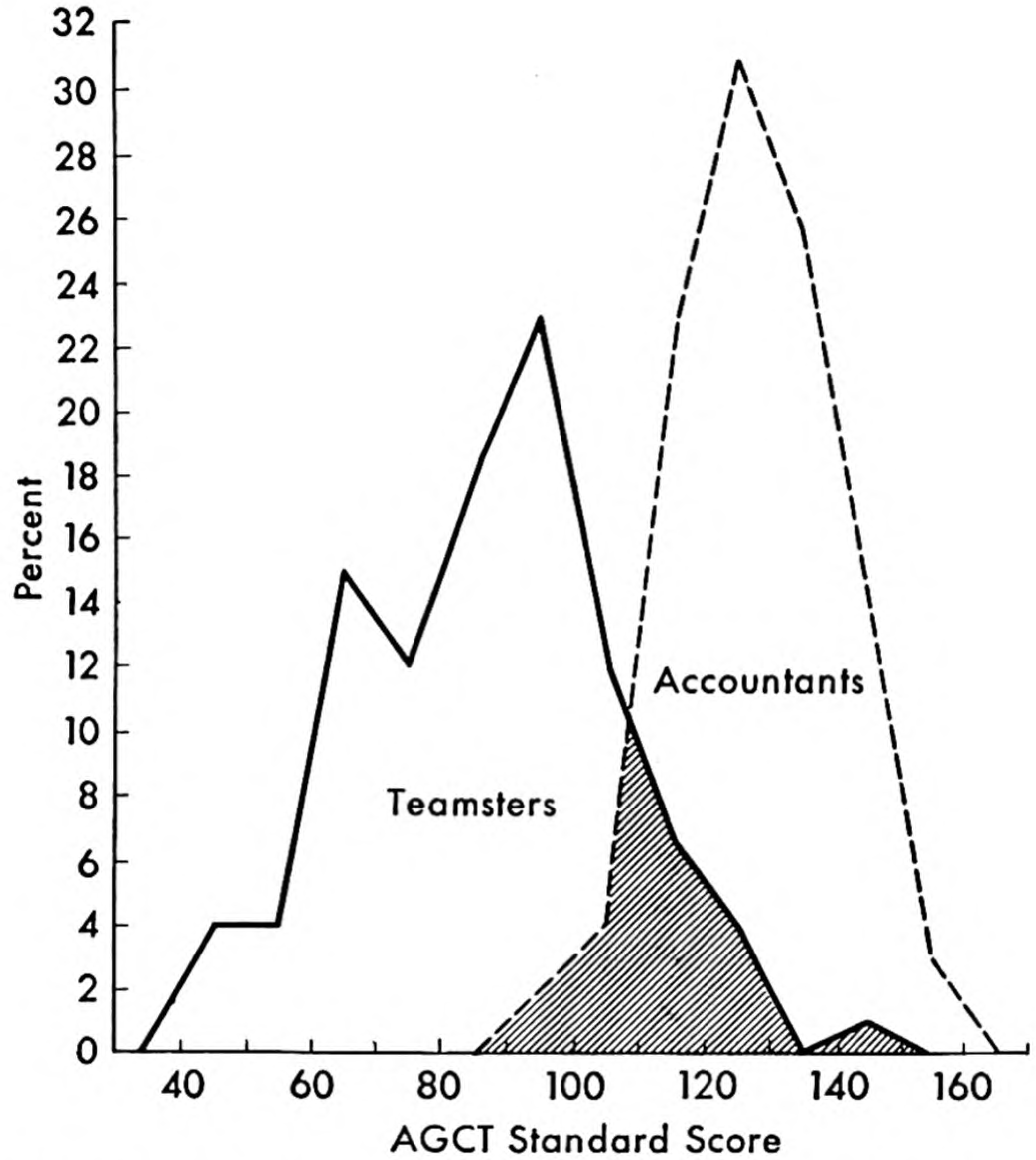


Fig. 116. Intelligence of teamsters and accountants. A study of many occupational groups in the Army during the Second World War showed that accountants were the highest large group of enlisted men, with an average AGCT score of 123, and teamsters were the lowest, with an average score of 88. But in spite of this big difference in the averages there was considerable overlapping. Some accountants were below the teamsters' average and some teamsters were above the accountants' average. (*Data from Harrell and Harrell.*[22])

fluctuating factors, like business cycles, local conditions, and temporary changes in the prestige of a job, such as occur during wartime.

But why do the children arrange themselves on the same intellectual ladder? Partly because they inherit the intelligence of both of their parents (and one must remember that intelligent men tend to marry intelligent women more often than not), and partly because parents in the upper economic strata give their children more advantages.

It is these self-perpetuating systems of reciprocal personal and economic forces which give our society its psychosocial structure, a structure which it has had since the breakdown of the feudal hierarchy. Social scientists do not expect much change within the next few generations.

*Urban-rural differences.* It is true that city people, both children and adults, do better on intelligence tests than country people, on the average. The difference is greatest in tests of verbal ability and least in mechanical abilities. The country children may know more about the birds and the bees than their city cousins, but they score lower on most tests, whether of aptitude or achievement. The cause of this state of affairs, which has been discovered in Europe as well as America, is not known. It has been alleged that the brighter people migrate to the cities, but the only evidence for this argument is its plausibility, and the reverse argument is equally plausible. In the few known cases in which identical twins have been separated early in life, one being raised in the city and the other in the country, the IQ differences averaged about 10 points. The inadequacy of the typical country school is the most likely reason for the low scores of the farm-bred children since schooling does have some effect on intelligence-test scores. In Scotland at least, where the country schools have well-educated teachers, the usual urban-rural difference is not found.[23]

*Racial and national groups.* Psychologists, like everyone else, would like to know something about the abilities of the different races and nationalities of mankind. There has been a lot of loose talk about the intelligence of Negroes and whites, about Nordics and Mediterraneans, and there has been a little careful research, but the obstacles in front of the scientists, even those who have brushed prejudice and sentimentality aside, are almost insurmountable. Some of the superficial questions can be answered, however. The question about the relative intelligence of Negroes and whites in military service is an easy one,

for whenever large groups are compared, the Negroes score considerably lower. Probably not more than a quarter of the Negro enlisted men in the Army reached the average of the white enlisted men. Comparisons of Negro and white children in the South show the same difference. Similar comparisons made in the North also disclose a difference in favor of the white children, but this difference is smaller, probably because the educational opportunities for Negroes in the North are not so bad as in the South. Mexicans in the United States score low, as do also the Italians and Poles. American Indians in general do poorly on intelligence tests, not at all the way James Fenimore Cooper would have predicted, though some tribes are much brighter than others, and a few are above the white average on performance tests of intelligence.[24] Several researchers have discovered that those Indians with the largest percentage of white heredity get the highest scores. American children of Chinese and Japanese descent are usually equal to the average for all American children. Jewish school children are the same as non-Jews. Blonds turn out the same as brunets; low-brows just like high-brows.

Those who wish to go deeper into the problem of group differences ask a more difficult question: What are the *causes* for these differences? Are Italians *as a whole* less intelligent than the Danes? Is the heroic American Indian *genetically* inferior to the paleface? Can the average Negro come up to the level of the average white if the dream of democracy should be fulfilled? These are the important questions, and these are the questions that cannot be completely answered. Anyone who seeks to settle these troublesome social and political questions should be aware of several technical difficulties.

The first obstacle is the sampling problem. It is true that Italians in New York get lower scores on intelligence tests than Scandinavians in Wisconsin, but these differences vanish when one looks for them in Rome and Copenhagen. Psychologists who have gone to Europe to compare several nationalities all come back with the same story, namely, the reasons for the nationality differences that occur in the United States are to be found in the political and economic conditions of the country left and the country arrived at when the migration took place. A hereditary national difference has not been proved.

Another big stumbling block interfering with the study of racial and nationality abilities is the effect of the environment on the test

scores. "Negroes make low scores. Negroes live in unfavorable environments. Therefore, the low scores are due to the unfavorable environment." The argument is entirely plausible, but it has certainly not been proved. It is also possible that the intellectually depressing surroundings of the average Negro account for only part of the difference, and that heredity accounts for the remainder. Genetically, the Negroes may be a little above the whites, or a little below. There is no sound scientific reason for expecting that Negroes and whites, or Lilliputians and Brobdingnagians, or any other pair of peoples must be exactly equal to each other in hereditary endowment. Nor, at present, is there enough evidence to say that they are not. Until the environments are equalized or an intelligence test is devised that will be free from the influence of the environment, this ancient conundrum will not be answered. At the moment only two definite statements can be made: (1) Negroes consistently score lower, *on the average*, than whites on all intelligence tests. (2) The intellectual opportunities open to most Negroes are shamefully inadequate.

In the case of the American Indian, some evidence has recently come to light, which illuminates one aspect of this problem. The Osage Indians of Oklahoma are one tribe which does not live in an unfavorable environment. Because of their royalties from the mineral rights of Osage County, neither their economic nor their social status is below that of their Caucasian neighbors. Furthermore almost everyone in the tribe speaks English. Yet the county contains full-blood Indians, fifty-percenters, and everything else, down to those of one sixty-fourth Osage ancestry. It seems an excellent chance to compare the genes of redskin and paleface, since the environments of the two are practically equalized. So Dr. John Rohrer,[25] of Oklahoma University, gave intelligence tests to most of the Osage children in Osage County. And, to clinch the case, he tested an equal number of white children in the same schools. The results are clear-cut. Average IQ for these 235 Indian children was 102, just about typical for children throughout the land. Average IQ for the white children, studying in the same school rooms, was just the same. Indians of half white ancestry got the same scores, on the average, as those of purer strain. In fact there was no relation at all between percentage of white blood and test scores. The natural conclusion is that, when those with more white blood are found to be more intelligent, it is because they have

shared more of the white opportunities, while in this case, when the rough life of the minority group has been smoothed by oil, there is no difference whatever.

This kind of comparison is very convincing. It is possible, of course, that these oil-financed Osage schools are superior to the average American school, superior enough to raise the intelligence of a natively inferior race. And perhaps the whites in these schools, who are equal to the Indians, are genetically inferior to whites elsewhere. And perhaps the Osage Indians are genetically superior to other Indian tribes. This experiment does not answer all the questions one might ask about race differences. But it does indicate what money can do when it is spread around widely enough over two generations.

Perhaps the most important practical question about group differences is one of possibility of improvement. The evidence on this question is less ambiguous. Northern Negroes are superior on intelligence tests to Southern Negroes, though they were all Southern Negroes once, and the records in Southern schools fail to show what might be suspected, that those who migrate North are brighter than those who stay. Furthermore, Southern-born Negroes who have been in the North five years get higher scores on intelligence tests than those who have been North only one year.[26] It is generally agreed among those who have studied these problems that good schools, good home environments, and, above all, the promise of a share of the world's goods and prestige, will do a great deal for a certain fraction of the present underprivileged third, whatever their color and origin, in respect both to the small matter of intelligence-test scores and the large matter of intellectual achievement and happiness.

***Heredity and environment.*** A classical controversy, which starts off arguments more quickly than most classical controversies, is the heredity-environment question. Some readers, following the paths of psychological development through earlier chapters, have probably noted how closely these two forces work together in the production of an adult human being—like eggs and fire in the production of fried eggs. Both are absolutely necessary; neither could turn out a finished product alone, so it is fruitless to ask which is more necessary than the other.

But in respect to living beings who do manage to get themselves born and reared—by a combined operation of heredity and environ-

ment—it is altogether logical and worthwhile to think of these as two separate factors and to try to assay the relative influence of each. Looking at the great range of IQ's shown in the tables and graphs of this chapter, one can ask whether these variations arise chiefly out of variations in the people's genes, which they are born with, or whether their IQ's are thrust upon them by the environmental vicissitudes of their growing years. Maybe the difference between one egg and another has been exaggerated—because one shell is white while the other is brown—and the differences observed in the finished products are largely in the frying. Or, it could be the other way round.

Geneticists like to study the inheritance of characteristics that are easy to see, like size and color, and they like to study these in plants and animals that multiply rapidly, like the banana fly. To prove that something is, or is not, influenced by heredity is a complicated task, which requires the gathering of many records and careful statistical analysis of these records. (In fact several of the statistical formulas in common use in psychology and economics today were invented in order to solve genetic problems.) The case is not proved by the description of one or two unusual relationships nor by drawing a genealogical tree. For these reasons good scientific evidence on inheritance in human beings, who take 20 years or so to breed—if they do—is meager, and most of that evidence applies only to the inheritance of physical characteristics, such as eye color, blood type, and rare medical disorders. Since intelligence, however, is one psychological trait that can be measured with fair accuracy, some evidence on the heredity-environment controversy has been obtained by statistical analysis of intelligence-test scores.

Some cases of mental deficiency, to begin with, can be easily recognized without the aid of intelligence tests shortly after birth, because they are associated with visible disorders of the skull, spine, tongue, or eyes. Many of these can be traced to poor nutrition, inadequate thyroid secretion, birth injuries, or infections. From research initiated by studies of such cases, scientists are gradually working out a catalogue of chemical substances required by the growing brain for normal development both before and after birth. In about three-quarters of the cases of mental deficiency, however, there are no obvious medical signs, the only weakness being an intellectual one and the only diagnostic instrument being the intelligence test.

In making up their intelligence tests, psychologists try to avoid

material that is obviously at the mercy of environmental contingencies. No one, for instance, would put in a question about the size of berths in a Pullman car because the topic is outside the experience of most people. Instead they ask questions like "What is the thing to do when you fall down and skin your knee?" They try to test abilities that develop internally, by maturation rather than by learning, or that may be answered from experience in any environment. In a sense, then, the question about the inheritance of intelligence is a question about how well the psychologists have succeeded in doing what they have tried to do. If a perfect intelligence test, one which is not susceptible to variations in environmental opportunities, could be constructed, obviously there would be no question about the relative influence of heredity and environment on scores obtained from such a test. The question today, however, deals not with such a hypothetical test but with the intelligence tests of today, which are widely used for theoretical and practical purposes.

The most clear-cut evidence comes from comparisons of identical twins. Identical twins, always of the same sex, have identical heredity, since they come from the same egg. They look like mirror images of each other, and usually grow up in the same environment, an outcome that does the scientist no good at all. But, after much searching, psychologists and geneticists have found a few pairs of identical twins, about 20 in all, who were separated early in life and thus matured in different environments. When such twins are stalked down, lured into the psychological laboratory, and tested by a standard intelligence test, the IQ's of both usually turn out to be about the same, but when one twin has had considerably more education than the other, the difference in IQ may be as much as 24 points. In a particularly rare case, the one twin with only 2 years of schooling got an IQ of 92 while the other, who had gone to college, made 116.[27] This large difference could not be due to heredity, since they were identical in this respect, and it is too large to be a result of inaccuracies in testing.

In general these pairs of identical twins have contributed their bit to science by proving that the environment *does* influence intelligence-test scores: small environmental differences produce small IQ differences, large environmental differences produce larger IQ differences. No gain can be expected, of course, when a child moves

from a school with 100 books in the library to one with 1,000. From a larger point of view, looking at the whole range of IQ's, from 0 to 200, the differences due to environment are not impressive. *The bulk of the variation in IQ throughout the nation must be due to hereditary differences.* If Americans were an inbred people, homogeneous in intellectual heredity, differences in environmental opportunities would play a relatively larger role. On the other hand, if Americans developed in environments equally advantageous to all, which is not the case now, the relative contribution of heredity to intelligence would be even greater than at present.

Twins of identical heredity and different environments are hard to find, but psychologists have many records of children who have moved from one environment to another, taking their genes with them. Often, in these infertile days, babies and young children are taken from parents of low intelligence or from an intellectually barren orphanage and adopted into comfortable homes with intelligent fostor parents. The change from the dull clock-regulated life in the usual orphanage, struggling along on an inadequate budget, to a stimulating home where the adults are interested in the children, tell them stories, and encourage their questions, is a change of great psychological magnitude. What results can the foster parents expect?

It is not easy to draw conclusions from the statistics on such cases, because intelligence tests are not dependable before the age of two and the records of the true parents of many of these foster children are not complete, but in general the conclusions as to heredity and environment are the same as the conclusions from identical twins. The usual result, under the present practices of the child-placing agencies, when a young child's environment is definitely improved, is a gain in IQ of 5 to 10 points within a few years.[28] Some gain more; some lose a little. Unfortunately it is not possible to say just which foster children will improve in an improved environment and which will not. Presumably those with the best heredity will improve most, but one cannot estimate a particular baby's intellectual inheritance accurately from a few facts about his mother and father, certainly not from the mother alone. Couples who decide to have children of their own are taking a chance; couples who adopt children are taking a longer chance. Couples who know their own heredity is bad run a smaller risk by adopting a child from a well-run child-placing agency

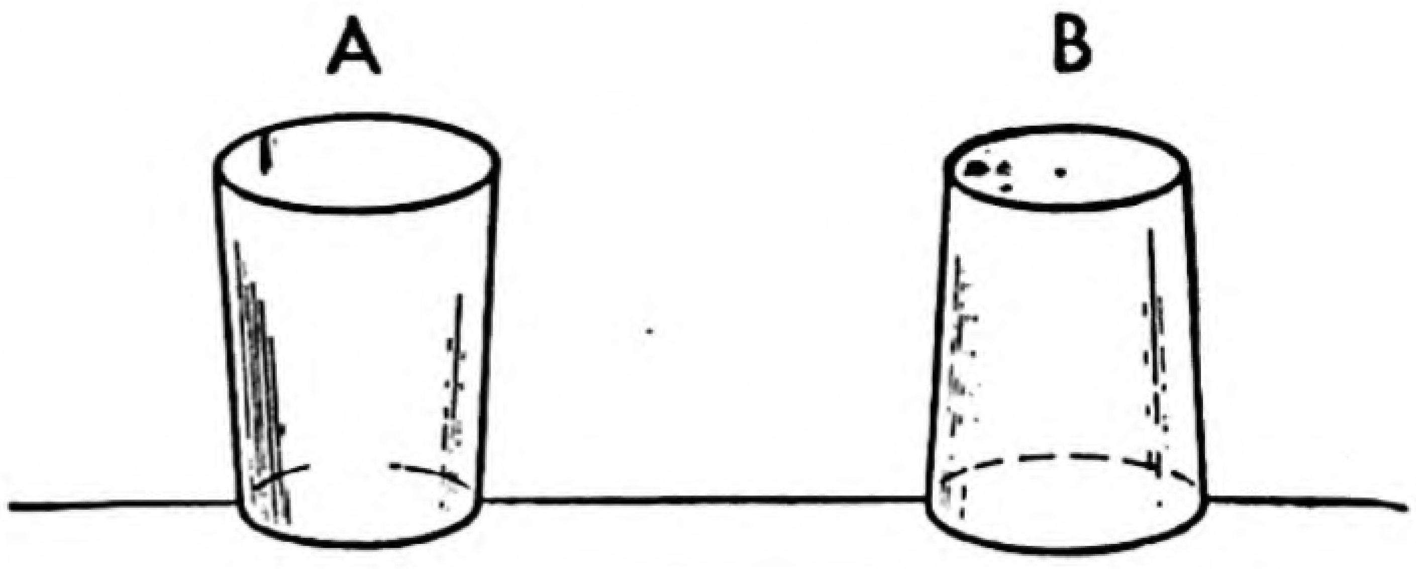
than by having a child of their own. Couples of superior heredity are wiser to let nature take its course.

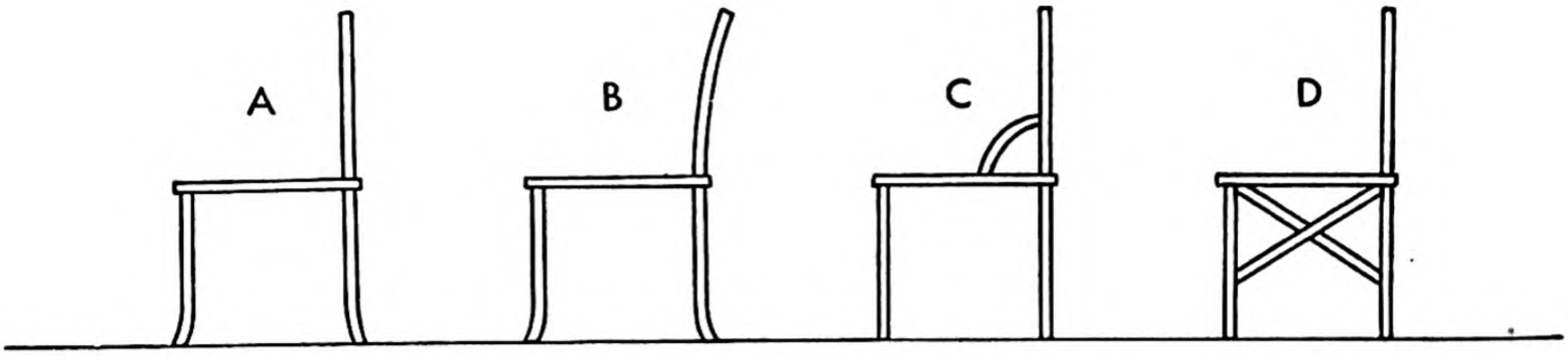
***U.S. IQ—up or down?*** There is good reason to think that the genetic basis of intelligence is deteriorating in civilized countries. In both America and Britain, when school children, whose IQ's are known, are asked how many brothers and sisters they have, it always turns out that in the larger families intelligence is lower, on the average. The correlation between family size and average IQ runs around −.25.[29] This correlation is quite small, meaning that there are plenty of exceptions to the rule. Nevertheless, many more children of low native intelligence than high are being born daily. We can estimate parents' intelligence from their children's, or the next generation's intelligence from this one's and thus compare two generations. Such indirect comparisons indicate a decline of 2 or 3 per cent from one generation to the next.[30]

Such comparisons are indirect. A more direct approach to this critical national problem would consist of actually testing, first, the parents and, later, all their children. This has not been done, but Prof. Frank Finch[31] of the University of Illinois has done the next best thing. He collected thousands of records of intelligence tests given to high-school students throughout the 20 to 30 years that they have been used, and he finds no decline whatever in average scores, but rather a slight increase. In two Midwestern high schools, which had been tested in 1923, he gave the same tests again in 1942. The population of the schools had increased but there was little immigration from outside, so that the parents of the children tested in 1942 must have been quite similar, when they were children, to the children tested in 1923. Yet over this interval of 19 years the average IQ of the children in these two high schools had risen from 100 to 104.

That is the picture at present. Whatever the decline in the inherited fraction of intelligence, it is being offset by improvements from the environmental side. This is nothing for the nation to be afraid of, or proud of. There is plenty of room for improvement from both the genetic and educational angles. If having four children could be made as fashionable in the upper socioeconomic brackets as having two cars, and if the expense of rearing and educating intelligent children could be reduced in some way, the negative correlation between family size and family intelligence might be decreased. And if the beneficial effects of education are spread around more widely, the next century's

1. These glasses have just been washed, rinsed and drained, then left to dry on a linoleum worktop. Which will dry faster?





2. If a child climbs on one of these chairs in order to get the jelly in the kitchen cupboard, which one is *least* likely to tip over backwards?
3. If the big wheel turns in the direction indicated by the arrow, will the pail of water be raised or lowered?
4. In which of these three illustrations is a truss shown?
5. In which is a windlass shown?
6. In which one would you be most likely to find a dowel?
7. In the manufacture of which of these is a joiner used?
8. In which illustration is a pinion shown?
9. What would you use if the belt in No. 3 slipped?
10. Which of the pieces below at the right, and how many of each, would be necessary for the construction of the model at the left?

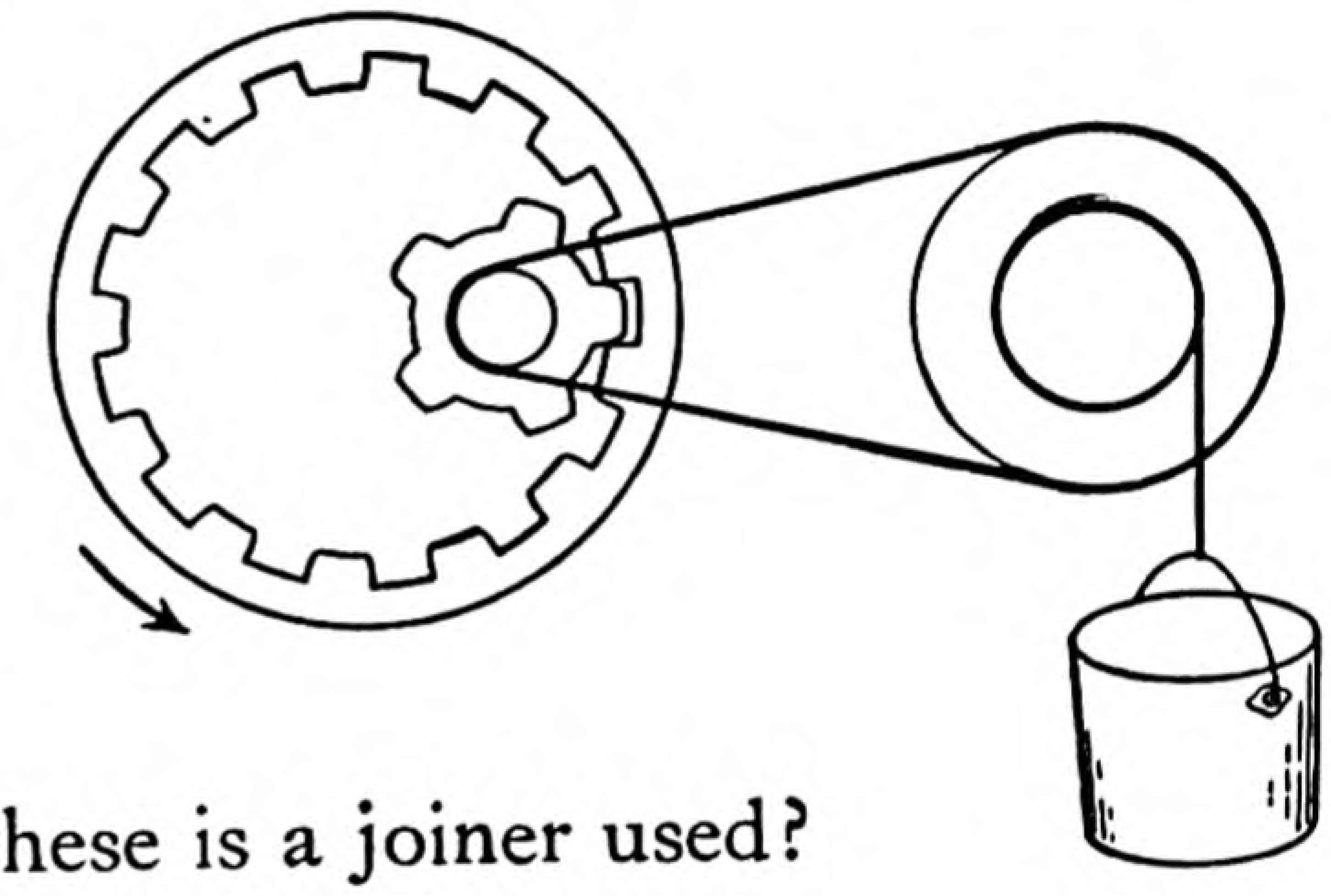
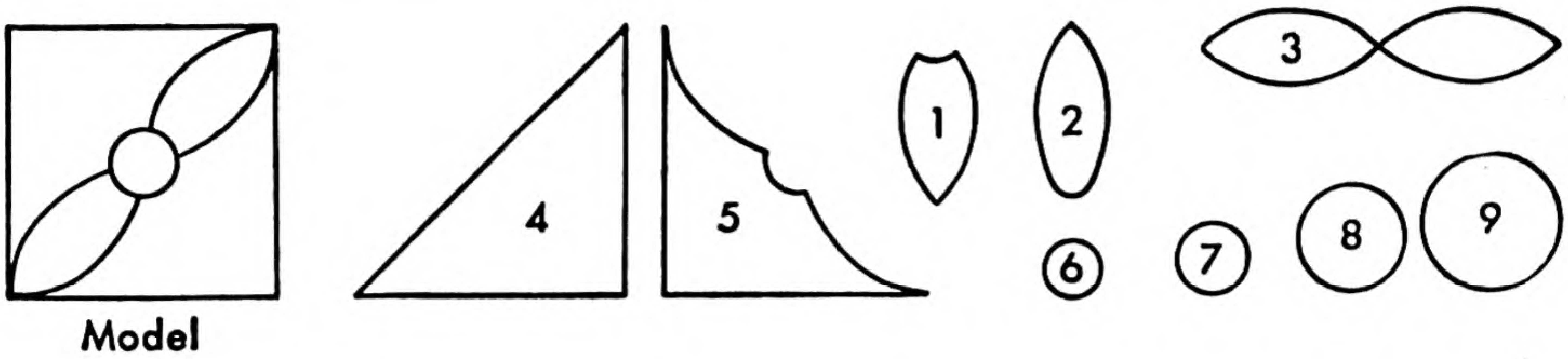


Fig. 117. A few typical

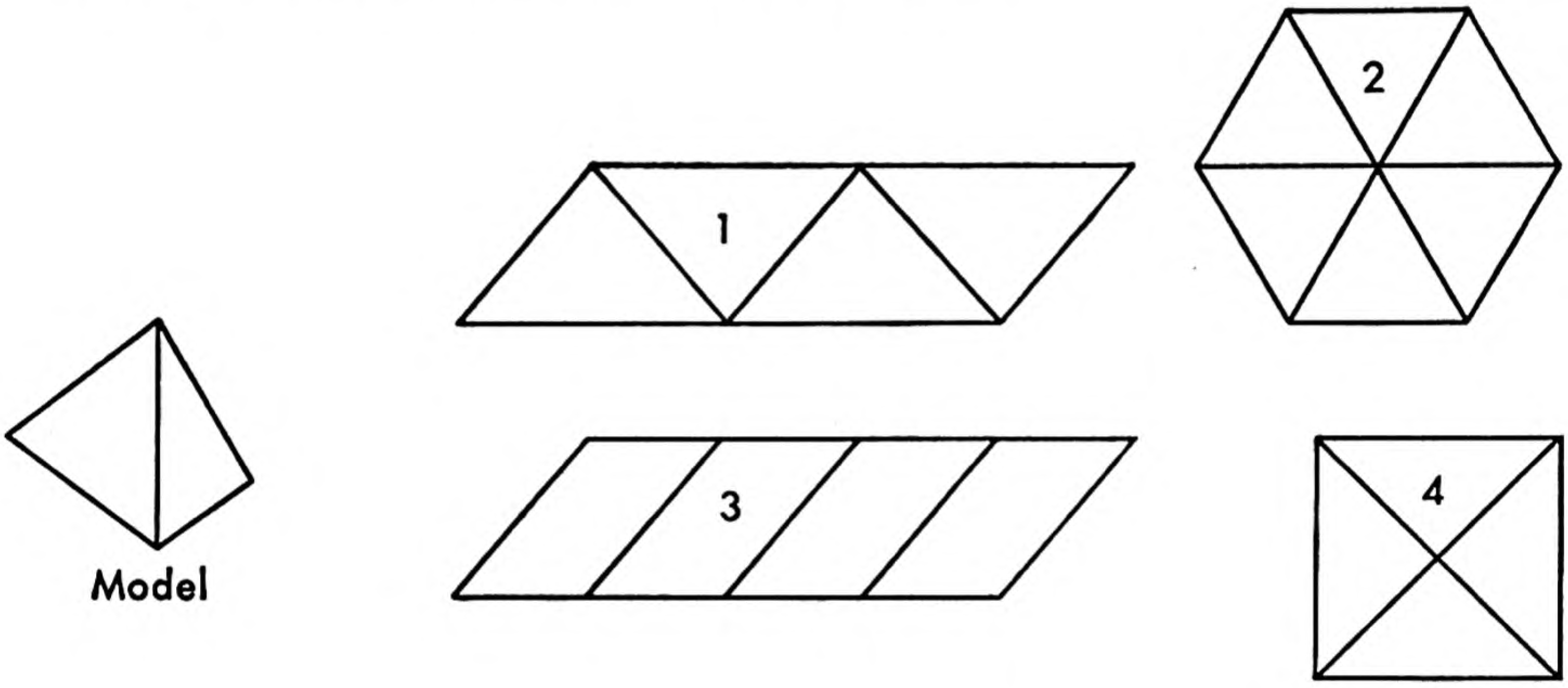
crop of human beings could be improved as much as this century's crop of soybeans has already been improved.

## MECHANICAL ABILITY

Americans are very proud of the mechanical skill of the youth of the land, especially when mechanized warfare is at hand. And modern industry requires a high degree of mechanical ability in thousands of different jobs. For these reasons psychologists have spent many hours inventing tests of mechanical abilities and analyzing their results. The kinds of questions asked on these tests are illustrated in Fig. 117.



11. The model is a solid object. The patterns below at the right represent pieces of paper. Which of the pieces of paper could be folded along the lines shown to make the model?



12. If a cube 3 by 3 by 3 inches, made up of 27 one-inch cubes, is painted on the outside, how many of the small cubes will be painted on one face, on two faces, three faces, four faces, five faces, and how many will remain unpainted?

questions on mechanical ability.

The first three questions test mechanical comprehension, or understanding of mechanical principles. Questions of this kind have been used in mechanical tests constructed by the military services to select men to be trained for mechanical jobs, and in tests sold commercially, like the Bennett Test of Mechanical Comprehension, which is used to pick out men for apprentice training courses and for engineering schools. Questions 4 to 9 test mechanical information and vocabulary. These questions are used to find out quickly, as in an employment office, whether an applicant for a job has actually worked around mechanical things. The abilities involved in getting high scores on tests of these two kinds are general intelligence, plus an interest in,

and experience with, things mechanical. Boys do much better on these tests than girls, chiefly because our culture encourages boys in that direction. Boys are given model airplanes to play with, while their sisters are told to keep themselves clean and neat. Whether there is a native difference between boys and girls in mechanical aptitude is an open question, which will be just as hard to settle as any other question about heredity and environment.

Space perception, the ability to judge what part belongs where, and to imagine what the other invisible side of an object looks like, is a highly important talent in designing, assembling, and inspecting jobs. Questions 10, 11, and 12 are of this nature. There are others earlier in this chapter and in the chapter on perception. Tests made up of such questions are used to predict success in courses in engineering drawing, blueprint reading, and layout work. Boys do slightly better than girls on these tests.

Mechanical comprehension, information, and space perception are the more intellectual aspects of what is usually called "mechanical ability." What some jobs require more than any of these, however, is simple manual dexterity, the coordination between eye and hand, or between the right hand and the left. This manual dexterity is not a general ability. There is no one test which will test muscular agility in general, for these skills are highly specific. Correlations between one and another are low. One man may be speedy and accurate on big equipment but not on fine work. Another may have good control of a pair of tweezers but show large errors when using a micrometer. These different independent skills have to be tested separately in order to predict success on a job where these skills are required.

In these manual abilities there is little, if any, difference between the sexes. Men will usually claim that they have accomplished more along these lines than women, but what about sewing, ironing, knitting, and dressing? The big group differences in coordination and speed of movement are age differences, for the old are much slower than the young. Since our population is growing older, it is comforting to note that there are a large number of mechanical operations, even in modern mass-production industry, in which judgment is more important than fine coordination. Even in surgical operations, with only a few exceptions, an error of one-eighth of an inch is less dangerous than an error of judgment.

## THE QUESTION OF SOCIAL SKILL

Everyone recognizes the importance of good social relations, and employers and voters reward expertness in this field; hence it would be pleasant to report that the psychologists have devised tests for the social skills that are as useful as the tests of intellectual and mechanical abilities. Actually very little has been accomplished. What makes testing of social skills difficult is that the tasks cannot be printed on paper and answered with a pencil. Paper-and-pencil tests work very well in testing intellectual abilities, and most clerical and mechanical abilities, but to demonstrate social dexterity one must manipulate people, not machines or pencils.

One necessary skill for manipulating people is communication, whether it is for commanding, explaining, entertaining, apologizing, or selling, and the word knowledge necessary for communication can easily be measured by a vocabulary test. But the actual putting over of an idea is something more; it necessitates taking the other fellow's point of view, noting gaps, anticipating questions and objections, and presenting the point in the most favorable manner. People who hope to be foremen, managers, confidence men, teachers, salesmen, lobbyists, or propagandists, need just such a social talent. This ability to take another's point of view, to adjust one's actions to his, as women do in following their dancing partners, is no doubt the foundation of many practical accomplishments.

Social insight, the power of seeing beneath the superficialities of people's behavior into the deeper motivations that make them tick, is another social skill that may spell the difference between success and failure in human relations. The socially skillful individual, the one whom others admire as a "smooth operator," need not be a professional psychologist—and he probably does not read books on how to influence people. He need not be able to explain his own actions to others, or even to himself, but he must be able to see far enough into his associates' and rivals' strivings, annoyances, and styles of life to discount the trivialities and to adapt his own actions and plans to these basic themes. Naturally a tactful person, who can handle other people, must be master of himself in a social situation, able to withstand his own emotions and to ignore the distractions of minor satis-

factions and irritations in order to carry out his major mission. (Several other social abilities are listed on page 242).

These social skills, like all others, are acquired by practice. An intelligent person, with good emotional control in a social situation, *can* learn the usual tricks of this trade. Whether he *does* or not depends on whether his natural social interests have been broken down by unfortunate experiences with other people, preventing him from turning the full power of his intelligence onto the acquisition of these skills. Interest in people, a personality trait that will come up in the next chapter, is almost a necessity for mastery of the social skills, especially during youth and early adulthood. The interest and the ability are not the same, however. There are lots of pleasant sociable souls who are interested in people but unable to use them as a means to an end, just as there are lots of asocial people who can shed their shells, if necessary, turn on the charm, get Mr. A to say a word to Mr. B, smile appreciatively at the right moment, and, in the end, get what they want out of the social situation. The analysis of leadership in Chap. 9 illustrates further the relation between the ability and the interest.

Although tests of these abilities comparable to tests of other abilities have not yet been worked out, some indication of a person's capacities for handling people can be obtained by putting him in a standard social situation with a standard assignment and observing his success. It is an old custom in the military services to judge an officer candidate by watching him put a squad of men through a difficult maneuver. The British Army is reported to have observed the social relations of officers on week-end maneuvers at a house party. In the United States, the Office of Strategic Services used a similar method for testing men who had volunteered for hazardous undercover work. A standardized interview, conducted before a board of examiners, is another promising method, especially when the examiners deliberately frustrate the candidate. The technical problems involved in such informal testing are extremely complicated, since the social tasks must be equally difficult for all candidates and since the examiners must be specially trained to judge the adequacy of the candidate's efforts. These fascinating new testing devices, close to the tests set by life itself, are still in the experimental stage. Research is being directed toward their reliability and validity. Present indications are encourag-

ing, though the technique will probably always be expensive, suitable chiefly for the selection of strategic or executive personnel.

Another, somewhat more convenient, way of predicting a person's social abilities uses records of previous social successes. A man or woman who has been active in school or business organizations, and has been elected to a responsible office, is a better than average risk in a job that calls for shrewd social relations. Such records are actually used by insurance agents in selecting salesmen, and they have the support of good validity coefficients.

## PSYCHOLOGICAL ABILITIES AND SUCCESS IN LIFE

There are some people who are captivated by intellectual contests, who enjoy flexing their neurons and scowling eagerly at any test of wits. Such restless intellects relish being asked who murdered whom in Hamlet, and in what order, or demonstrating their ability to work parlor puzzles. There are actual pathological cases of compulsive acquisition of useless knowledge comparable to the familiar cases of self-centered preoccupation with physical appearance. Most struggling citizens of this competitive world, however, are interested in intellectual capacities, not for their own sake, but for what can be done with them, their usefulness in the battle for fame and fortune.

People with IQ's below 70 are usually considered *feeble-minded*, or mentally deficient. But there are degrees of *mental deficiency*. From 70 down to 50 they are called *morons*, from 50 to 25 *imbeciles*, and below 25 *idiots*. The naming, of course, is not very important. The decision to commit a person to an institution, or to give him a special course of training, and what kind of a course, is made on the basis of personality, occupational potentialities, and health, as well as IQ.

No one denies that mental deficiency is a handicap in life. Few adults with IQ below 50 are able to support themselves, and those below 25 are completely dependent upon others for protection from common dangers. In the IQ range between 50 and 70 some manage to get along quite well, especially if they are not irritable and can hold a simple job, but a large percentage find themselves in trouble of one sort or another, and constantly in need of help. Many of these high-grade defectives can be made useful to themselves and society by special training procedures adapted to their abilities and to the require-

ments of the available jobs. Because of the man-power shortage of recent years, several training schools for the feeble-minded have accumulated encouraging statistics on the occupational adjustment of some of their alumni. It is this marginal group, to be sure, that is hit hardest by business depressions.

**Genius.** At the other end of the scale of intelligence, the end that carries the burden of social progress, are those brilliant prodigies who startle their parents, teachers, and psychologists by their intellectual precocity.[32] John Stuart Mill (1806-1873), the English philosopher and economist, whose influence on logic is still strong, was one of these. He was reading Greek when he was three, and at eight he was studying Latin, algebra, and geometry. He wrote a history of Rome in his seventh year. Later, when he was twelve, he helped his father with a history of India. At sixteen he turned round and taught these, and more advanced subjects, to his younger brothers and sisters. His IQ must have been above 170. Goethe (1749-1832), who has been called the greatest poet of any age or country, was another precocious youngster. In his seventh year he was arranging and conducting plays on a miniature stage which his grandmother had given him. Before he was eight he was writing poetry, some of it in Latin. About the same time he built an altar and devised his own mystical pathway to God. In his studies at nine he was competing with boys of sixteen to twenty-two, but he did allow himself to be distracted from his study of Latin in order to master a little Italian which he overheard now and then from his sister's tutor. In his twenties, when he wrote some of his immortal poetry, he was practicing law and studying medicine on the side. His comments after the staggering Lisbon earthquake, which shook men's faith in Providence, are illuminating: "After all, it is probably much simpler than they suppose. God knows that the immortal soul can suffer no harm through such a fate." [33] This when Goethe was six years old.

A group of psychologists at Stanford University, headed by Lewis M. Terman, whose Stanford-Binet intelligence test is widely used, has been collecting biographical records of geniuses for many years, showing how intelligence is spread out over the pages of history and refuting many of the superstitions about child wonders. Dr. Catherine Cox, for instance, actually went back into the old accounts of the early lives of 300 of the most eminent men and women of history to

find out what they did when they were young. Knowing the ages at which average children can read and write, learn algebra, and use words like "suffer" and "fate," knowing, that is, the mental ages required for these feats, and the ages at which these extraordinary youngsters did these things, one can easily compute an IQ for each one. Three psychologists rated each historical figure in this way. In those cases for which adequate records were available and the three psychologists agreed, the average estimate can be taken as the minimum IQ that will account for the facts. They gave Mill an IQ of 190 for his childhood and 170 for his youth. Goethe scored 185 for his childhood and 200 for his youth. Others that are worth knowing are Pascal, the mathematician, with 180; Macaulay, the historian, 165 to 180; Coleridge, the poet, 170; Voltaire, the French writer, 175; John Quincy Adams, sixth President of the United States, 165. (Adams taught English to the French ambassador when he was twelve, read Voltaire and Cicero when he was fourteen.) Longfellow, Scott, Tennyson, and Wordsworth, all poets, had IQ's near 155 or 160. Mozart, the composer, had an IQ of 155, George Washington, 135. Interesting also are the examples of men like U. S. Grant and Oliver Cromwell, who made their mark on our civilization even though their intellectual accomplishments rank them only a little above the average.

Hardly any of these 300 eminent characters had IQ's below 120, the average being 155. Those who made their reputations as philosophers averaged 170, the poets, novelists, and dramatists 160, the scientists 155. The lowest were those who became famous as soldiers, for their average was 125. Nearly all, except the artists and musicians, were versatile intellects, far above their fellow men in several lines of accomplishment. More than half of them were drawn as children to the field of their later fame, many pursuing their talents in spite of parental opposition.

Starting with eminent names and working *backward* to childhood is only one way of showing the relation between intelligence and worldly success. Professor Terman and his colleagues[34] at Stanford University have painted the picture on the other side also, by starting with a group of extraordinarily intelligent children in their school years and following them *forward* for 25 years. The great increase in scientific knowledge of intelligence in action that has come out of this

large-scale study of gifted children shows what can be done with a long-time point of view—and a hundred thousand dollars.

They began by searching for children with IQ's of 140 or higher. In 1922 they had found about fifteen hundred boys and girls out of a quarter million possibilities in California schools. Then all that remained was to wait and see what happened to them. Would they fulfill the promise of their childhood? Or would they, in accordance with the folklore of the day, finish their careers in beer parlors, insane asylums, and jails? Since Professor Terman was able to keep track of nearly all of them (1,425) until 1940, the question can be given a clear and definite answer.[35, 36]

Of these bright children, 86 per cent went to college, where they distinguished themselves both in scholarship and campus politics. Those who were married in 1940, about 70 per cent of them, married men and women less intelligent than themselves (where could they find their equals?) but definitely above average, and their children are likewise high in IQ. Average IQ for the children tested was 127, as compared with the average of 150 for the original group of parents. (The reasons for the lower intelligence of the children have been discussed on page 338.) Insanity, epilepsy, alcoholism, delinquency, and divorce were less frequent in this group than is common in California.

During their college days the boys had earned altogether a half million dollars. Although most of them finished their education during depression days, their average salary at age thirty was $3,000 a year, and even during the depression, very few were unemployed. Up to 1940, though they were still young, they had published hundreds of articles in technical journals, at least twenty books, and a large number of short stories, popular articles, and poems. They held over eighty patents. During the war the men did their share both in combat and in technical specialties. About twenty have distinguished themselves in one way or another. And 20 out of 1,425 is quite a remarkable proportion, especially for people still in their early thirties. Also, the range of occupations includes those as humble as carpenter, policeman, gardener, telephone operator, and filing clerk.

Although the women in this remarkable group were equal to the men in achievement all through school and college, the majority dropped out of competition when they married. Hence, as Terman

points out: "The exclusive devotion of women to domestic pursuits robs the arts and sciences of a large fraction of the genius that might otherwise be dedicated to them." [37]

Professor Terman's notes on four of these prodigies follow: [38]

> A professor in one of the physical sciences and head of his department in a great university. Has published three textbooks, more than 50 research articles, and has taken out more than a score of patents. Well known nationally and internationally.
>
> A brilliant student who took his master's degree at 20 in classical literature, then turned to business and at 27 became chief investment analyst for a forty-million-dollar educational foundation.
>
> A musical composer of international reputation, nurtured in poverty and totally unschooled until the age of 17. He is the author of three books and dozens of articles on musical theory. In the last three years alone he has composed 60 major orchestral works, written a book on melody and learned two foreign languages.
>
> An artist in his middle twenties who is an important member of Walt Disney's staff with a salary of $1,000 a month.

***The middle range of intelligence.*** So much for the rare individuals at both extremes of the scale of intelligence, the very dull and the very bright. From inspection of Fig. 106 anyone can see that the percentage of people below 70 and above 140 is quite small. A generalization about the contribution of intelligence to worldly success, which will apply to the general run of people, including the 95 per cent who are neither feeble-minded nor gifted, is established in a more prosaic manner. The achievements of those above average in intelligence, in schoolwork for instance, are compared with the achievements of those below average. In fact, the introduction of many eager freshmen to college life is the intelligence test given to them by college personnel experts in order to predict scholastic success and failure, and to identify those who need special help. Correlations between intelligence and college grades are usually between .50 and .60.

The connection between intelligence and economic attainment in the burly world outside the schools is obscured by more contingencies, to be sure, but this connection can be traced by following high-school and college students for several years after graduation and comparing their economic progress with school records of their performance on

an intelligence test. In general, it is clear that those with above-average scores have the edge on their below-average classmates when the facts are gathered 10 years later. This advantage operates in kind of job as well as income. Intelligence contributes more to the performance of intellectual functions, as in professional, technical, executive, and research activities, in clerical jobs of the more complex sort, in skilled work, and in all jobs of a supervisory nature, than in jobs that depend chiefly on physical or social skills. Some of the larger employers, with modern personnel policies, have surveyed the jobs in their organizations, determining for each the minimum intelligence necessary. Employees below this minimum usually fail to do enough work to justify themselves. Those above this minimum usually are satisfactory; if they fail, the deficiency is not an intellectual one. In some jobs the intellectual requirements are surprisingly low. A mental age of nine is sufficient for simple assembling, packing, sewing, bottling, and cleaning. Indeed, if the work is monotonous, and jobs are plentiful, the above-average employee may be less satisfactory because he is more likely to get bored and quit.

It is a necessary conclusion from the known facts that this thing called "general intelligence" is the most important single factor in success or failure. Such a strong statement is true because the consequences of intellectual activity are so widespread, affecting the outcome of practically all of life's struggles, whatever the motivation, whatever the conditions. It is true also because individual differences in intelligence are so great. The average student, whose daily contacts are, by and large, with other people in the same general range of intelligence as himself, does not realize what an impressive difference there is between a person with an IQ of 80 and another, who may look no more nor less acute, with an IQ of 120. It is in a situation where all kinds of people are thrown together, as in an army induction station, that the wide spread of intellectual ability can be appreciated.

In specialized occupations, other abilities, mechanical, social, physical, artistic, or what not, bulk larger in the outcome. Our culture rewards the possession of many peculiar talents, like yodeling, filibustering, and going through channels, as well as many diverse personality traits (which will be described in the next chapter). Add to

all these the influence of pure luck, happening to be in the right place at the right time, and it becomes obvious that success is a hazardous affair. All that psychologists, sociologists, and economists have been able to do is discover a few general trends.

## THE SELECTION OF PERSONNEL

This connection between psychological traits, like intelligence, and success in many of life's demands, even though it is a tenuous connection covered up by many other variables, is one of great importance for modern industry. It constitutes the rationale of modern methods of selection of personnel in large organizations. Because of this connection, it is possible to use a test, or battery of tests, for measuring an applicant's abilities and predict from these his probability of succeeding on the job. The technique is simple in principle, though often difficult in operation.

It is necessary first to analyze the requirements of the job. A *job analysis*, as it is called, carried out by someone thoroughly familiar with what the job takes, or by an expert in job analysis, will indicate intelligence required, special skills, hazards, usual causes of error, waste and expense, and whatever other personal qualities are needed to get the work done. There are usually hidden requirements that cannot be detected, but a preliminary survey by experts gives a beginning, and some hunches. Analyses of similar jobs in other organizations, when these are available, add further suggestions.

Taking all these suggestions, facts, and hunches together, the psychologist builds a selection procedure, which attempts to predict which applicants will succeed on the job and which, if hired, would fail. Often an intelligence test is used, but the requirement of a certain amount of education may in some cases serve almost as well. Other tests of mechanical skills, clerical, muscular, and what not, are included if the job seems to call for them. In special cases tests of emotional stability, interest in the job, and other personality traits have been used. It is all a matter of guesswork at first, though, if the requirements of the job are well known, the guesses will be fairly accurate. Tests already available are used, if convenient, but often tests have to be constructed to fit the job. In some cases information from the ap-

plicant's background has high predictive value. In the selection of men for sales-promotion jobs, for instance, the applicant's background is particularly significant. A married man will sell more insurance on the average than a single man. Information about a man's personal history, like club membership, reason for leaving last job, number of dependents, and monthly expenses, are quite valuable when properly used.

The next, and most important, question is whether, in actual practice, the predictions from test scores and background data will work out as expected. Will the applicants with high scores actually do better on the job than those with low scores? This question, the question of the *validity* of the predictors, is the central question of the whole procedure, which can only be answered if the organization has a good *criterion* of success on the job. The criteria commonly used are measures of output, as indicated by number of boxes packed, number of holes drilled, number of parts assembled, sales records (if it is a selling job), or, if more objective records are not at hand, ratings by foremen and supervisors as to general usefulness to the company. When the psychologist has these figures, *i.e.*, the scores of 100 employees on the tests, together with records of success and failure on the job, it is a simple matter to correlate the two and see if the one predicts the other. If so, the selection program is a good one; if not, it is worthless. The decision is an empirical one, dependent on a comparison of predictions with actual outcomes.

The logic of this comparison shows that it is impossible to overemphasize the importance of the criterion. If the direct measure of success on the job is itself inaccurate, no predictor can be expected to check with it. And in actual practice the criterion on success usually is loaded with error. A machine operator's output depends not only upon his ability but upon his teammates as well, the customs of the shop, the difficulty of the operation, and the quality of the material. A salesman's monthly record is also pushed up and down by conditions beyond his control. Supervisor's ratings of employees are notoriously unreliable. Up-to-date personnel experts are familiar with ways of circumventing these sources of error, adjusting output records according to the difficulty of the operations, correcting sales records for variations in the market, and training supervisors in methods of rating

subordinates, but the accuracy of prediction will always be limited by the inaccuracy of the criterion being predicted.

It is for this reason that military psychologists in the Second World War who were able to select trainees and predict success in passing courses with relatively high validity, were constantly frustrated in attempting to set up a program for the selection of combat leaders. At the conclusion of training courses for pilots, mechanics, radar operators, cooks, radio telegraphers, and finance officers, a good criterion was available immediately. The trainee passed, or he washed out. But in predicting behavior under combat conditions the problem of the criterion was practically insurmountable.

Often the predictions are fair but not good. Some of the predictors do separate the successful workers from the unsuccessful and some do not. This leads to a process of refinement, weeding out the useless questions, improving the more promising ones, and trying again. The ultimate problem is whether the improvement in quality of employed personnel under modern selection methods is sufficient to justify the time and expense of an up-to-date personnel system. For the validity of an employment test, after all, comes down to a matter of cost accounting.

An experiment conducted by Dr. John T. Shuman[39] of the Williamsport Technical Institute offers a good example of the modern procedure for checking on the practical value of psychological tests in an airplane factory. The workers were inspectors, engine testers, machine operators, foremen, job setters, and toolroom learners, 363 in all. They all took three tests, an ordinary intelligence test, a test of mechanical comprehension, containing questions like Nos. 1, 2, and 3 of Fig. 117 on page 348, and a test of ability to perceive and compare geometrical designs, made up of questions like those on page 130. When the scores of all employees were analyzed, it turned out that those with high scores on these tests were in general superior to those with low scores, according to the judgment of their supervisors. The mechanical comprehension test was the best; the use of this test alone would produce an improvement of 19 per cent in the quality of the personnel, while the test of spatial ability accounted for a 14 per cent improvement. When the different jobs were studied separately, Shuman discovered that the intelligence test was the best for the selection

of engine testers (the validity coefficient was .57), while the test of mechanical comprehension was practically useless for this purpose (the validity coefficient was .17). But the mechanical-comprehension test had the highest validity of all for predicting the performance of job setters (validity, .73) and inspectors (validity, .67). In practice two or three of the most valid tests are used in combination. The multiple validity coefficient then is usually a little higher than that of the best single test.

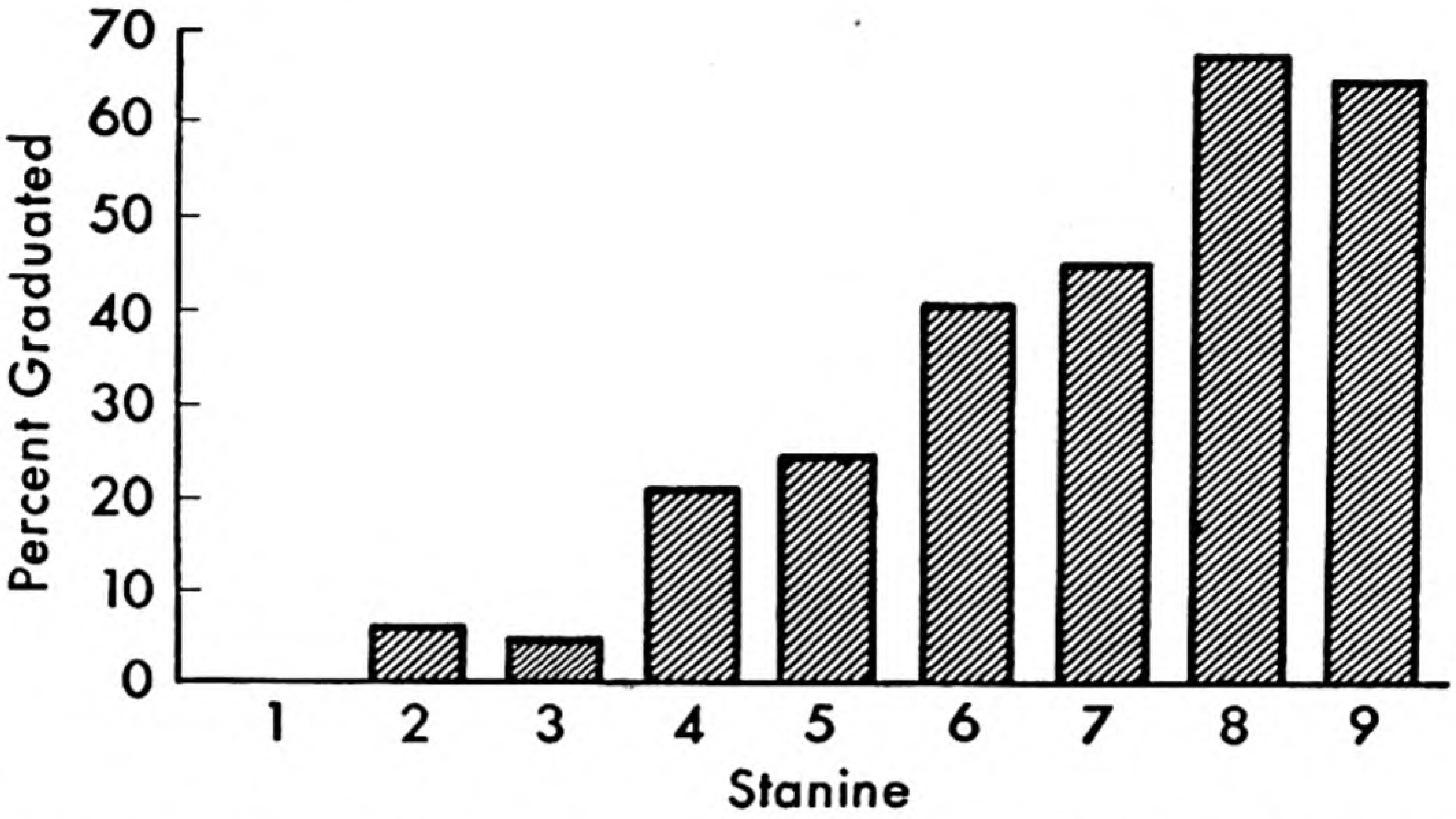


Fig. 118. Value of pilot Stanine for predicting graduation from pilot training. Stanines are standard scores used by the Army Air Forces for combining scores on a battery of tests. As an experiment, a thousand men who wanted to fly and who could pass the physical examination were tested by this battery, then their scores were filed away, and they were put through the regular training program, from preflight to advanced. A quarter of them graduated. When the test scores of the whole thousand were studied, it turned out that none with a Stanine of 1, the lowest score, made the grade, but over 60 per cent of those with Stanines of 8 or 9, the highest scores, won their wings. (*Data from Flanagan.*[40])

For another example of modern personnel selection consider the air-crew of the U. S. Army Air Forces. In 1943 it was known that the selection procedures were working well, picking out the best men for training and rejecting the poorest. But as an experimental checkup, 1,000 men were tested and sent through training regardless of their test scores—just to see what would happen.[40] Figure 118 shows the results for pilots. None of those who received Stanines (see page 310) of 1—and there were 150 of them—graduated; all were washed out for one reason or another. Of 139 who got Stanines of 2, about 6 per cent were graduated as pilots, and so on. Of the 98 who scored 8 or 9, over 65 per cent graduated. The validity coefficient was .64.

Stanines are standard scores constructed by combining the scores on

several tests. Taking the tests separately, the best test for the selection of pilots was the test of general information (the validity coefficient was .51), the next was a test of instrument comprehension (validity, .48), and the next was a test of mechanical comprehension (validity, .43). A record of biographical data and a test of spatial orientation were somewhat less valuable. These tests are all printed and convenient to give to large numbers of candidates at once. The apparatus tests of discrimination reaction time (validity, .42), rudder control (validity, .40), coordination, and the like, were also of moderate value.

Selection procedures in the British military services are similar to the American ones, and in the recent war were similarly successful. For example, one validation study[41] followed up 16,000 mechanics and fitters selected and trained by the Fleet Air Arm. Among those who had been selected by the tried and true old-fashioned methods, the failure rate was 15 per cent. Among those selected by personnel officers working under a psychologist, the failure rate was 5 per cent.

Japanese selection tests and procedures were weak imitations of American methods. As far as could be determined by postwar interrogation of Japanese officers, they did not follow up their selections as carefully as we did.[42] The Germans depended less on objective tests and more on observation of the men by experts. They, too, did not follow up their work objectively as the British and Americans did.[43]

## SUMMARY

The construction and use of psychological tests require a good working knowledge of statistics, so a few simple statistics have been described in this chapter: the mean and the median, which are averages, the standard deviation, which is a measure of the scatter of a distribution of scores, and the correlation coefficient, which is a measure of the relation between two sets of scores for the same people.

Abilities are tested by putting people in standard situations and giving them standard tasks to do under conditions of optimum motivation. The construction of a psychological test begins with an analysis of what the test has to do. With this analysis as a background, the test expert makes up a tentative test, tries it out, and improves it in accordance with the results in actual operation.

Two statistical hurdles a test must surmount if it is to be accepted

by psychologists are reliability and validity. Reliability refers to the consistency with which the test assigns scores to people and is expressed either by the correlation coefficient or by the error of a score. Validity refers to the usefulness of the test for some specific purpose and is expressed by the correlation coefficient or by measures of the error of prediction.

For some purposes the raw score on a test is used, but for many other purposes the raw score is converted to an age score, such as a mental age or MA, a percentile score, or a standard score.

The IQ for children is a measure of rate of intellectual development and also a standard score. For adults, the IQ is only a standard score.

Intelligence can be defined as the most general ability or, what amounts to the same thing, as the ability responsible for success on the widest variety of problems. That general ability seems to be, more than anything else, an aptitude for abstract thought. The abilities of man can also be divided up, if need be, into several more or less independent factors; the best-known such abilities are verbal, numerical, and spatial.

Intelligence increases rapidly up to age fifteen and declines slowly after twenty-five. Creative ability also reaches its peak early in life. Aside from these age differences the most important differences are those between the various socioeconomic groups.

When the whole range of scores on modern intelligence tests is considered, intellectual ability is related more closely to hereditary differences than to environmental ones, but in the case of differences between races, the heredity-environment controversy has not yet been settled. There is good reason to infer that the genetic basis of intelligence is slowly deteriorating in highly civilized societies, but the IQ is held up by educational advances.

Mechanical ability has been divided into mechanical comprehension, information and vocabulary, ability to perceive spatial patterns, and dexterities of many kinds. Any one of these, or a combination of several, may be necessary for success in a specific mechanical job. There are no doubt many important social skills, but these have not yet been well tested.

Intelligence has been shown to be very important for success in life by the study of mental defectives and the geniuses of history, as

well as the general run of people. This relation between psychological abilities and success supplies the principle behind modern methods of selecting personnel for civilian and military jobs.

### TECHNICAL TERMS FOR SPECIAL STUDY

ability
test
speed test
power test
achievement test
aptitude test
group test
individual test
verbal test
performance test
standardized test
equivalent forms
reliability
internal consistency
split-half method
day-to-day consistency
retest method
validity
age score
age norms
raw score
mental age
frequency diagram
frequency curve
normal distribution
normal frequency curve
percentile norms
percentile score
profile
psychograph
median
standard score
standard deviation
IQ
correlation coefficient
reliability coefficient
validity coefficient
general intelligence
verbal ability
numerical ability
spatial ability
feeble-mindedness
mental deficiency
moron
imbecile
idiot
job analysis
criterion of success

### NOTES ON TERMINOLOGY

*mental:* an old-fashioned term used to differentiate intellectual functions, like learning, from muscular functions, as in "mental test" and "mental deficiency."

*genius:* phenomenal intellectual ability, especially of a creative sort.

*intellectual:* see mental.

[illegible]

[illegible] be taken as typical:

7. 4. [illegible] 60

8. 5. [illegible] 50

9. 6. [illegible] 55

# II

## PERSONALITY—THE CLIMAX OF THE STORY

It is altogether fitting that the last part of a psychology book should deal in personalities. A human personality is a marvelously intricate structure, delicately woven of motives, emotions, habits, and thoughts into a pattern that balances, however precariously, the pulls and pushes of the world outside. This section will draw the threads together and complete the pattern begun in previous chapters. But there is a very important difference between this field of psychology and those that have gone before. The psychology of personality deals, not with general psychological principles, like motivation and learning, nor with differences between people in abilities. We are concerned rather with particular people; the center of attention shifts now to the individual as a unique person.

Scientific psychology began with the study of general laws of behavior and has made its greatest progress in this area, as shown by the first two-thirds of this book. People's activities were classified and lumped together so that general trends could be observed and generalizations stated that would be valid for the average person, and in some respects for all people. The individual human being was not the principal object of study; he was important chiefly as a statistic, as a contribution to the average or general law. But now, in the middle of the twentieth century, an interest in the individual *for his own sake* is nothing to be ashamed of. Respect for the dignity of human personality, any human personality, is a central value in the great democratic tradition. We want to describe different people as completely and satisfyingly as possible—not hypothetical or average people, but specific human beings, including the man who steps up to borrow a match, the housewife next door, and the student who wears those funny clothes. We want to analyze them and find out what makes each one the unique person he is. Later in this chapter we shall turn

to the development of personality, trying to account for the origins of those curious bundles of natural phenomena which go by such names as David Stone, Mrs. De Giacomo, and Miss Eisner.

## THE DESCRIPTION OF PERSONALITY

One of the first tasks in any scientific undertaking is to describe the material under investigation. The chemist may describe his material in terms of appearance, weight, and reaction to certain standard reagents. The economist is likely to describe business conditions in terms of amount and kinds of goods and securities exchanged, price indexes, and so on. How can human personalities, which differ from each other in so many intangible ways, be described? Actually, people have been talking and writing about other people for years, sometimes carelessly and emotionally, sometimes thoughtfully. Two examples of a well-recognized literary form, the *character sketch,* which has just this function of describing a personality, are printed here for illustration. The first is part of a letter about General Washington written to a friend by Thomas Jefferson.[1] It is dated Jan. 2, 1814.

> . . . I think I knew General Washington intimately and thoroughly; and were I called on to delineate his character, it should be in terms like these.
>
> His mind was great and powerful, without being of the very first order; his penetration strong, though not so acute as that of a Newton, Bacon, or Locke; and as far as he saw, no judgment was ever sounder. It was slow in operation, being little aided by invention or imagination, but sure in conclusion. Hence the common remark of his officers, of the advantage he derived from councils of war, where hearing all suggestions, he selected whatever was best; and certainly no general ever planned his battles more judiciously. But if deranged during the course of the action, if any member of his plan was dislocated by sudden circumstances, he was slow in readjustment. The consequence was, that he often failed in the field, and rarely against an enemy in station, as at Boston and York. He was incapable of fear, meeting personal dangers with the calmest unconcern. Perhaps the strongest feature in his character was prudence, never acting until every circumstance, every consideration, was maturely weighed, refraining if he saw a doubt, but, when once decided, going through with his purpose, whatever obstacles opposed. His integrity was most pure, his justice the most inflexible I have ever known, no motives of interest or consanguinity,

of friendship or hatred, being able to bias his decision. He was, indeed, in every sense of the word, a wise, a good, and a great man.

His temper was naturally irritable and high toned; but reflection and resolution had obtained a firm and habitual ascendency over it. If ever, however, it broke its bonds, he was most tremendous in his wrath.

In his expenses he was honorable, but exact; liberal in contributions to whatever promised utility; but, frowning and unyielding on all visionary projects, and all unworthy calls on his charity.

His heart was not warm in its affections; but he exactly calculated every man's value, and gave him a solid esteem proportioned to it.

His person, you know, was fine, his stature exactly what one would wish, his deportment easy, erect and noble; the best horseman of his age, and the most graceful figure that could be seen on horseback.

Although in the circle of his friends, where he might be unreserved with safety, he took a free share in conversation, his colloquial talents were not above mediocrity, possessing neither copiousness of ideas, nor fluency of words. In public, when called on for a sudden opinion, he was unready, short and embarrassed. Yet he wrote readily, rather diffusely, in an easy and correct style. This he had acquired by conversation with the world, for his education was merely reading, writing and common arithmetic, to which he added surveying at a later day. His time was employed in action chiefly, reading little, and that only in agriculture and English history. His correspondence became necessarily extensive, and, with journalizing his agricultural proceedings, occupied most of his leisure hours within doors. On the whole, his character was, in its mass, perfect, in nothing bad, in few points indifferent; and it may truly be said, that never did nature and fortune combine more perfectly to make a man great, and to place him in the same constellation with whatever worthies have merited from man an everlasting remembrance.

The second example consists of excerpts from a *New Yorker* profile * by Richard O. Boyer.[2]

Joseph Curran, president of the National Maritime Union, the world's largest trade union of sailors, is a bleak man of forty with menacing brown eyes and a nose scalloped by repeated fractures. His air of scornful righteousness and his size—he is six feet two and weighs two hundred and seventeen—give him at times the appearance of the only adult in a world of children. His body is so massive and angular that a sailor once said, "I'd as soon run into a jagged boulder as run into Joe." He has a head like a

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block of granite, a gray complexion, a loud, angry voice, and the attitude of a man constantly struggling against an impulse to commit mayhem. His constituents, numbering about ninety thousand, approve of his noisy, truculent manner. They take it as evidence that the comforts of life ashore have not diminished the salt-water toughness which was all he was known for when, only ten years ago, he was a working seaman like themselves. Just before the N.M.U. threatened to call a strike a few weeks ago, a militant, red-faced seaman named Jimmy O'Grady visited Curran's office at headquarters to make a minor complaint against the union. Curran arose and advanced threateningly on him, shouting something about throwing him out the window. O'Grady backed out beaming. "Thank God!", he said to a friend, "Joe's still just a sailor at heart."

Curran has the appearance and the bearing of a sailor, but he has the responsibilities and outlook of a world statesman. He frequently says, with awe, that his organization, which is C.I.O., is the only trade union whose activities encircle the earth. . . . Wherever there is water deep enough for a ship to float, there members of the N.M.U. can generally be found. . . . Most of the members are, like Curran, rough, salty extroverts; they were described in a United States Maritime Labor Board report in 1939 as "the most fiercely independent segment of labor to be found any place in the world."

His office, which is on the top floor, is equipped with indirect lighting, walnut panelling, oil paintings, a scimitar-shaped glass-topped desk around which twenty can be seated, deep, green leather chairs and davenports, and ship models. Curran finds all this impressive enough, but when he looks into the council room that adjoins his office, he is even more impressed. . . . The place has the dignity and solemnity of a United Nations Security Council room. . . . Curran, however, does not permit his surroundings to intimidate him. Weekly staff meetings, which are customarily attended by a dozen of the union's department heads, are usually held in his office, and he often brings them to order by calling out, "Come on, you guys! Steam is up. Train's ready to go!" If one of the heads happens to start criticizing another, Curran may interrupt by coldly inquiring, "Who you tryin' to kill?" If members of the staff start quarrelling, he says, "Let's not have an Irish Parliament here!" After a somewhat acrimonious meeting, he is apt to remark, "The ceiling was splattered with blood." On the whole, his speech is edged with violence. His way of advising a subordinate official to discharge an employee is to say, "Cut off his head!"

When Curran goes home to his wife and two-and-a-half-year-old son, Joseph Paul, he is another, and a quieter, man. They live on the top floor of a five-story walkup, in a pleasant five-room apartment overlooking the

Hudson River near the George Washington Bridge. As a family man, Curran is as gentle and sentimental as Wallace Beery. He likes to spend long evenings at home lying up in the bunk, as he puts it, reading or listening to the radio. His handsome, cheerful, red-haired wife, whom he calls Red, was a stewardess on a passenger liner before they were married, in 1939. When Curran has to stay downtown at night to work, he says, "I miss my little family," and usually he will find time to call up his wife. "Hello, Red," he says. "Remember me? This is your husband. How is my guy?" The guy is his son.

Curran's evening of reading in bed usually lasts until 1 A.M., and he always takes more than one book with him. One night a while ago, he went off to bed with "Infant and Child in the Culture of Today," "The Complete Works of Shakespeare," "The Book of the Scottish Terrier," "Fancy Rope Work," and Robert's "Rules of Order," as well as that day's *Times*, *Tribune*, *Mirror*, *News*, *World-Telegram*, *Post*, *Daily Worker*, and *PM*. "I read 'em all," he says. "A labor leader has got to be more than popular. He's got to know what's going on."

Few men look more indestructible than Curran, but he worries a lot about his ulcers and about his health in general. "I take all the shots in the book," he says. "I took forty-one last year. For typhus, tetanus, cold, malaria, and then I took a whole series for sacroiliac." His spine was injured some years ago, when a Portuguese sailor who had gone insane during a storm at sea swung on him with an axe. Curran has a physical examination four times a year, and he recommends this for all seamen in his column in *The Pilot*. He is inclined to make an ethical and philosophical generality out of any habit of his. He believes that what is good for him is good for mankind; his column also recommends reading in the bunk until 1 A.M., keeping up with all the newspapers and the radio, and becoming conversant with Robert's "Rules of Order."

Looking back over these sketches analytically, one can see what writers do when they write about people. They describe appearances: "Stature exactly what one would wish." "Nose scalloped by repeated fractures." They describe specific acts: "Curran arose and advanced threateningly on him." And they generalize about habitual styles of action: "Never acting until every circumstance, every consideration, was maturely weighed." Furthermore, they occasionally attempt to dig below the surface to find the motivational and emotional sources of the observed behavior: "His temper was naturally irritable and high toned, but reflection and resolution had obtained a firm and habitual ascendency over it." "The attitude of a man constantly struggling

against an impulse to commit mayhem." They include the opinions of others: "The common remark of his officers." "Joe's still just a sailor at heart." While all students of personality, literary and scientific alike, are interested in the personality as a whole, in actual practice they break it down into separate characteristics or traits. Further analysis will show that these writers have reported on their subjects' speech, interests, reading habits, social relations, habits of thought, ethics, and sources of fear and embarrassment. Jefferson, writing about Washington, leans toward direct statements about abstract qualities or traits, such as prudence, judiciousness, integrity, fluency, and greatness, while Boyer prefers to list specific colorful details in such a way that the reader easily combines them all into a vivid unitary impression.

Whatever the purpose of the description, much selection takes place. There is no use describing everything a person does. He eats, wears shoes, reads the evening paper, scratches his ear, signs his name, talks to friends, sits down, stands up, and so on. His actions may be characterized as abrupt, absent-minded, abstemious, academic, accommodating, accurate, acquiescent, acquisitive, active, adventurous, and so on, to zealous and zestful. There is practically no limit to the number of ways in which people can be described, for the English language has thousands of words that can be used as names of personality traits. (Two psychologists [3] actually examined all the 400,000 words in the 1925 [*sic*] edition of Webster's *New International Dictionary* and counted 17,923 trait names.) One of the first steps, then, in any systematic description of personality is the selection of the characteristics or traits that are to be observed.

**Personality traits.** A *personality trait* is a distinctive aspect of a person's behavior, some consistent characteristic of his style of life by which he may be compared and contrasted with others. Certainly it is the consistent characteristics of a person's behavior which we want to describe. If a man throws a stone at a cat once, that is hardly important. But, if he consistently throws stones at cats, and also at dogs, squirrels, birds, and chipmunks, this stone-throwing tendency is something we ought to know about. The technique for determining how consistently people act in any respect is exactly the same as that used in computing the reliability or self-consistency of a test (see page 295). People are observed on different days in different situations and the number of sociable, aggressive, sympathetic, rapid, or tense acts is

counted each time. Or they are tested on different days. A set of sociability scores, let us say, for 100 people in one situation is correlated with another set of scores for the same people in another situation. If the correlation is high, it indicates that these scores represent a stable consistent characteristic of these people's conduct, *i.e.*, a personality trait.

Often, when the data are all in, it turns out that the measures are not consistent. One person scores high in aggressiveness in one situation and low in another. A child is honest at recess but cheats in the classroom. When this happens, the psychologist looks again at his technique and attempts to sharpen it. Perhaps the examiners need to be better trained. Perhaps the test needs to be lengthened, or refined. When the scores are accurate but the descriptions obtained from them are inconsistent, the only logical conclusion is that the people are inconsistent. In respect to honesty, for example, serious well-financed research with school children has failed to produce evidence of consistency. Children just do not have such a trait in general; to describe them by such a trait name is deceptive. The amount of honesty shown in different situations depends, not so much upon the character of the child as upon the character of the situation, the social pressures, and the child's interpretation of the expectations of his pals. Such a conclusion is disappointing to those who want people completely surveyed and labeled, once and for all, like the curator's neatly printed description of a mummy in a museum case. But for the genuine student of personality the inconsistencies are just as informative as the consistencies.

Here, as in so many other noble human projects, it is words that have led thought astray. Because there is a word "honesty," it is easy to assume that there must be a trait, honesty, and that people can be usefully compared with each other in respect to honesty. Modern psychology, however, has learned to be wary of words and not to expect consistency of behavior unless there is some better reason for consistency. Furthermore, we now know some of the reasons for consistency.

The biological substratum of behavior makes some aspects of behavior consistent. Possibilities here are emotionality, degree of activity, irritability, strength of some drives, intelligence, and probably some others. These characteristics of behavior are determined by some char-

acteristics of the nervous system, the glands, and the blood chemistry, which operate quite consistently. Such traits are often called *constitutional traits.*

Generalization of conditioning produces another kind of consistency. The training a child gets in his early family experiences spreads to other, similar situations. If he is tense in the presence of his parents, he is likely to generalize this tension to the presence of schoolteachers and other adults, and be reasonably consistent about it. If he has been scared by girls on a few occasions, he is likely to be scared when he meets other girls. This is a familiar principle of learning, in this case a simple automatic sort of learning. If the living room in his house is a place to perform his show-off tricks, he is likely to see the living room in the house next door as a similar opportunity. These traits can be called *habit traits.*

A person's concept of himself and his role in society is another factor in consistency. The person who thinks of himself as a liberal will usually try to act like a liberal. Adults, unlike children, do have self-conscious standards of honesty, some rigid, some flexible, and most do test their behavior as to its consistency with their standards. A person who pictures himself as a man of action, like Joe Curran, is going to act like a man of action, with some degree of consistency. And the crucial point is, that if he acts like a man of action long enough, he becomes a man of action. Thoughtful people, who take themselves seriously, are likely to be more consistent than others, especially so in respect to those traits which seem most important to them—just for this reason alone. Traits of this sort can be called *ego traits.*

These, then, are the three chief reasons for consistency of personality. If there are no reasons for consistency, people will not be consistent. Modern psychology does not expect people to be consistent in the amount of any trait under consideration unless proof is given. For example, if the amount of insecurity a person shows cannot be measured, tested, rated, photographed, or recorded in some way with a reasonably small error, there is no point in using this term for describing people, or in trying to account for the origin of insecurity, or the effects of insecurity on marital happiness or anything else.

After the requirement of self-consistency is met, any trait that aspires to official recognition as a guide line or dimension of personal-

ity must meet the next requirement, which goes by the name of *validity*. In general, any characterization of a person is valid precisely to the extent that it agrees with the actual activities of that person, and consequently, the devices used for checking the validity of any single trait measurement depend, like anything else, on the purpose of the description.

When a personality test is used for the selection of employees, its validity is the accuracy with which it separates successful and unsuccessful employees. For such purposes, the sole aim is prediction, as in the case of mechanical or clerical tests, and employment psychologists are not much concerned with any fundamental analysis of the predictors as long as they will predict. When the aim of the description is more general, directed toward a more comprehensive understanding of the individual, the kinds of activities to which the trait descriptions are compared are much more varied. Scores on a test of dominance, for example, are correlated with the frequency of dominant activities in different social situations. Measurements of emotionality made by electrical apparatus in the laboratory are compared with behavior outside the laboratory. A trait that does not correlate with some significant activity of the individual has no psychological pertinence, no validity, however interesting it may be by itself. Such a trait is hair color. The difference between blonds and brunets may be a fascinating topic for casual conversation, but there is no evidence that this difference is related in any important way to any difference in the behavior of real people. Handwriting is another one. There is no doubt that a person's style of handwriting is characteristic of him, is, in fact, a consistent trait. But, before handwriting means anything for the psychology of personality, its relationship to actual behavior must be proved. In contrast to these is a trait like sociability, which is a factor in a person's adjustment to many conditions of civilized life. When one's characteristic degree of sociability is described with adequate reliability, his personality is that much better understood and his behavior in life's hurly-burly that much more predictable.

The naming of personality traits is a minor problem connected with validity. Traits have to be designated in some way, and the usual practice has been to identify them by a name like dominance, selfishness, or sociability, because there is a backlog of more or less dependable information stored in the common language, which aids scientific

communication. Such naming is valid, of course, just to the extent that this name corresponds to the behavior indicated by the dictionary definition of the trait name. When psychologists use common terms for personality traits, they are usually careful to qualify the description by indicating its origin, as in these two statements: "Jones is above average in persistence, according to the Ryan Test." "Kalish is low in popularity, according to ratings by her classmates." There is less opportunity for confusion, naturally, when traits are given new names, such as extroversion, surgency, oral erotism, and $BN_2$. Tests constructed for a specific purpose, such as the selection of life-insurance salesmen, are often named according to that purpose, rather than according to the personality traits tested. Many questions, for example, dealing with interests, aspirations, living standards, and previous experience have been assembled, in suitable combination, so as to give a total score called "Aptitude Index for Life-insurance Salesmen." This name and the scores from the test are valid just to the extent that it delivers high scores for good salesmen and low scores for poor salesmen.

## SYSTEMS OF DESCRIPTION

As the psychology of personality has advanced and the number of traits investigated has multiplied, the necessity for classifying these traits in some systematic arrangement has become apparent. The most fundamental distinction is that between *common traits* and *individual traits*.[4] The more systematic and quantitative side of the psychology of personality deals with common traits, traits that everyone shows in some degree. Everyone, for example, is irritable to some extent; everyone displays some degree of sociability, judiciousness, gloominess, and so on. Hence, if the techniques are adequate, anyone can be tested or rated and compared to others in these aspects of personality. Contrasted with these are individual traits, like a guilt feeling over a high-school escapade, which may be the central feature of one personality but quite irrelevant to most others. Joe Curran's inclination "to make an ethical and philosophical generality out of any habit of his" may be considered an individual trait, since many people simply do not make such generalities at all. Individual traits are hard to investigate and validate, but we shall return to this topic later in the chapter.

A common trait like irritability is not, of course, directly observed.

When Thomas Jefferson writes that General Washington's temper was "naturally irritable," he is making a generalization about his behavior on the basis of many specific instances. Terms like "irritability," "sociability," and "judiciousness" are abstract concepts, which one learns, partly from personal experience and partly from reading and conversation, just as one learns the concept of "mammal" (see page 178). One must learn not only the meaning of the trait name, but also the amount of the trait shown by the average person and the range of variation above and below the average. In other words, one learns a scale or frame of reference as a background against which terms like "irritable" and "slightly irritable" can be evaluated. To judge or rate personality in respect to a common trait such as irritability, one abstracts from the ebb and flow of behavior those aspects pertinent to this concept, things like emotional outbursts, facial gestures, and changes in tone of voice, then combines these signs into a general statement of the subject's position on the conceptualized scale of irritability: "He is irritable." "He is not irritable." "He is very irritable." If the writer's observations are adequate, and if writer and reader are using the same scale as a frame of reference, the reader's knowledge of the subject's personality will be increased. A numerical score obtained from an objective test describes a person more precisely, of course, and is easier to interpret if the test has been adequately standardized and norms, such as percentiles, are available. The mark of a man is always a relative mark, and any score or word has meaning only in relation to some known frame of reference. (The importance of the frame of reference in judgment was discussed in Chap. 8, and percentiles were discussed in Chap. 10.)

After describing, by test or rating, how irritable a person is, one could go on to describe how peevish he is, how petulant, fretful, cross, irascible, emotional, excitable, hot-tempered, moody, and grouchy he is. But these traits overlap each other. One who is high on two or three of these traits is high on the others. It would be an absurd waste of effort to grade a person according to every trait one can think of. What psychologists desire for many purposes is a convenient number of common traits, more or less independent of each other, chosen so that scores on all traits will outline the subject's personality with reasonable completeness. The statistical methods employed in this quest

for a manageable scheme of personality description are the same as those used in analyzing abilities (see page 320), but the quest is more difficult, because the personality is more complicated than the intellect. There is no large general factor, for example, like general intelligence. There is no one correct classification of personality traits for the same reason that there is no one correct classification of library books, or flower seeds. The most useful scheme will depend upon the age of the subjects to be analyzed, their educational background, their cultural background, and, above all, on the purpose of the analysis.

One small area in which the analysis has been reasonably successful is the vocational interests of high-school and college students. After getting students to answer 483 questions about their likes and dislikes, G. Frederic Kuder,[5] of the University of Chicago, sorted out the answers and resolved this complex into nine basic dimensions or lines of interest: mechanical, computational, scientific, persuasive, artistic, literary, musical, social-service, and clerical. The advantage of this scheme is that these nine lines of interest are almost independent of each other, showing little overlap, yet amongst them all anyone's vocational interests are fairly well covered. For these reasons the Kuder Preference Record, and others of the same sort, are widely used in vocational counseling.

When the subject of a personality study has been scored on a number of traits, the scores are usually converted to some convenient scale, like A, B, C, D, and E, or to the percentile scale. Then it is common practice to collect the scores and put them all together on a psychograph or profile (see page 306), as in Fig. 119. Such psychographs, when inspected by one who is familiar with them, give a quick appraisal of the subject in respect to these common traits.

In view of the great variety of ways in which people can differ from one another, the task of simplifying the description of personality seems almost impossible. While one psychologist in California is discovering that Trait A and Trait B are closely related and may in fact be different names for the same thing, some other psychologist in Liverpool may be breaking Trait C down into $C_1$ and $C_2$. The question of how many personality traits there are and how they are related to each other is as complicated, to say the least, as the parallel question about the number of vitamins, or the number of government agencies, or of public-utility companies. But, in spite of all the difficulties, some order is being brought into this young science.

The most comprehensive analysis of this sort, aimed at the discovery of the primary dimensions of the human personality as a whole, has been carried on by R. B. Cattell, beginning in England 15 years ago and now going forward at the University of Illinois.[6] One of the outcomes of this extensive research is a catalogue of personality traits, which may be described briefly as an illustration of an up-to-date list of common traits. When a person has been rated on these traits, a big step has been taken in the assessment of his personality. The ground plan has been charted; the details can be filled in later.

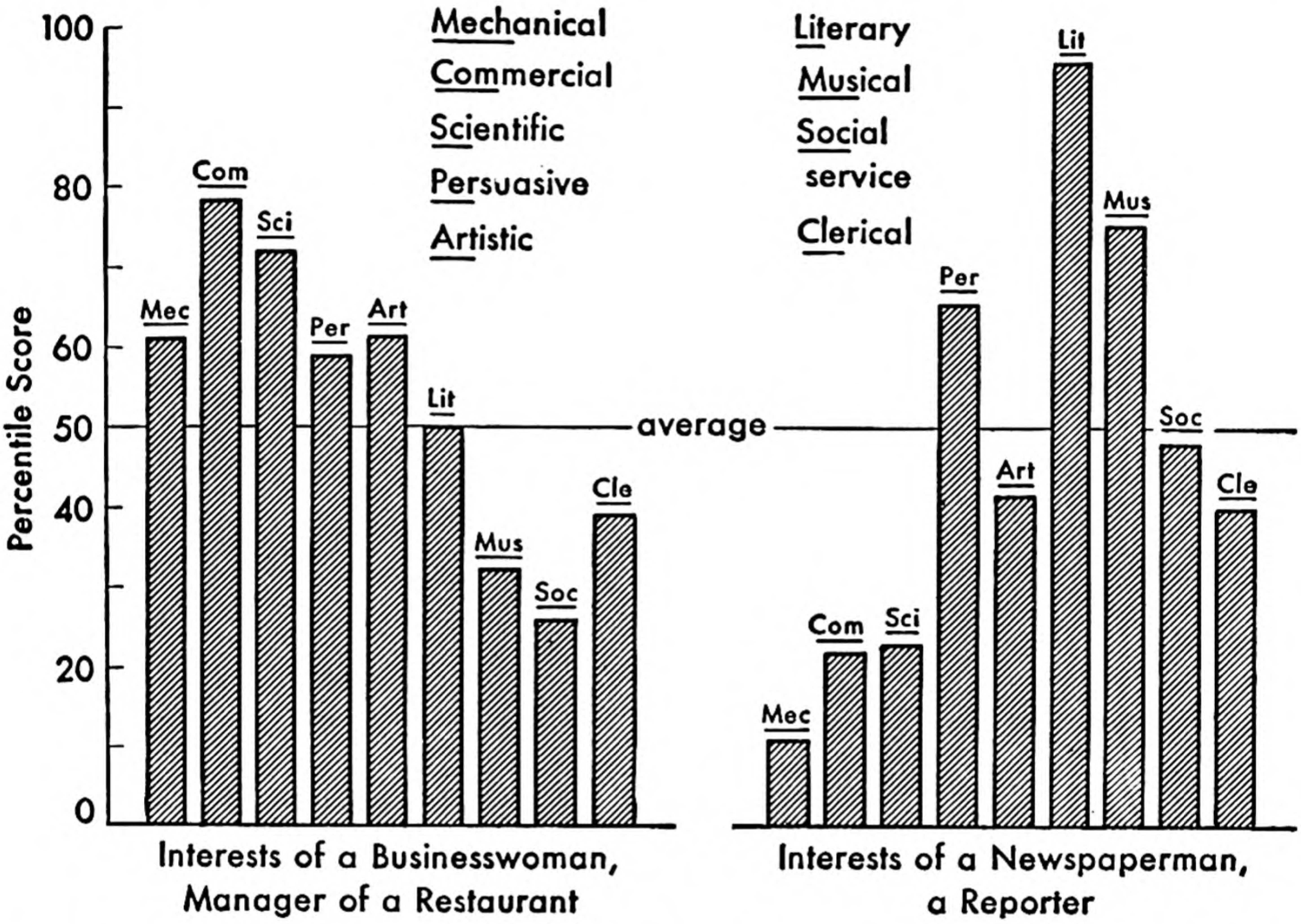

Fig. 119. The interests of two people analyzed into nine different factors. (*Data obtained from the Kuder Preference Record.*[5])

***Schizothymia.*** This trait gets its name from the fact that many people exhibit behavior that resembles, in a mild way, the behavior of the mental disease called schizophrenia (see page 435). When given a personality questionnaire, one who is high in schizothymia describes himself in these terms:

1. Troubled with shyness
2. Keeps in the background on social occasions
3. Does not make new friends easily
4. Has feelings of being watched on the street

Also characteristic of schizothymia are such traits as tenacity, secretiveness, inflexibility, and a tendency to cover up one's emotions. At the opposite end of this dimension of personality, called the *cyclothymia* end, are such characteristics as trustfulness, genial adaptability, emotional expressiveness, and generosity. Woodrow Wilson would be rated on the schizothyme side, Abraham Lincoln on the cyclothyme side. Most people, of course, would fall near the middle. This trait is placed first on the list because the difference between behavior at one end of the scale and the other is so marked and contributes so strongly to the basic outline of the personality.

***Intelligence.*** It is not necessary to remind anyone who has read the chapters on intelligence and learning how general intellectual capacity enters into the acquisition of the more subtle behavior patterns. The role of intelligence will be emphasized again later in this chapter.

***Emotional maturity.*** Maturity of an emotional sort is associated with realism in facing life's problems, steadfastness, and freedom from both inner emotional upsets and outer susceptibility to temptations. A person low on this trait will usually give affirmative answers to questionnaire items like:

1. Frequently in low spirits
2. Lonesome, even with others
3. Frequently feels grouchy
4. Gets discouraged easily
5. Feels not adjusted to life

People who get into trouble with the law are more likely than others to show signs of emotional immaturity.

***Dominance.*** Dominant people are also characterized as adventurous, willful, egotistic, forceful, self-confident people of wide interests. On questionnaires this trait is indicated by these responses:

1. Is not easily discouraged when opinions of others differ from his own
2. Is not troubled by feelings of inferiority
3. Likes to sell things or solicit funds for a cause in which he is interested

***Surgency.*** This is Cattell's term for placid, unemotional, realistic cheerfulness, with talkativeness, enthusiasm, sociability, and witty

originality. Low surgency, called *melancholia* when extreme, is indicated by these responses:

1. Is often miserable (for no reason)
2. Worries over possible misfortunes
3. Has frequent ups and downs of mood
4. Is meditative and introspective
5. Is not carefree and cannot relax

**Sensitive anxious emotionality.** This trait is the central core of such overlapping traits as (1) tenderhearted, sympathetic emotionality, (2) imaginativeness, and (3) timidity. It shows up on items such as:

1. Is easily startled
2. Suffers from insomnia
3. Is easily distracted
4. Is inclined to express emotions easily
5. Feels that he uses more energy than most in getting things done

Women score higher on this trait than men. The other pole of this dimension is represented by a hard-boiled, independent individual with some smugness and overprecision.

**The cultured mind.** It should be no news to the reader of a book like this one that people differ enormously in the amount of cultural sophistication they have acquired. Trained socialized individuals are characterized by these interests:

1. Is not more interested in athletics than in intellectual matters
2. Generally prefers to lead in group activities
3. Inclined to study the motives of others
4. Has a vital interest in such problems as "whether the industrial age dulls most people's appreciation of beauty"

Obviously, well-educated people will rank higher than the average on this trait.

**Character integration.** By this Cattell refers to the source of such characteristics as responsibility, perseverance, and conscientiousness, including ability to control distractions and worry. A person high on this trait:

1. Does not desire constant change of work
2. Does not worry about possible misfortunes

3. Is not suspicious of others' motives
4. Is not impulsive
5. Is slow and deliberate in manner

**Obsessional inflexibility.** This is a factor of nervous vigor, energy, and perseverance, with ability to endure pain if necessary, as opposed to languidness, daydreaming, and slackness. The person high on this trait:

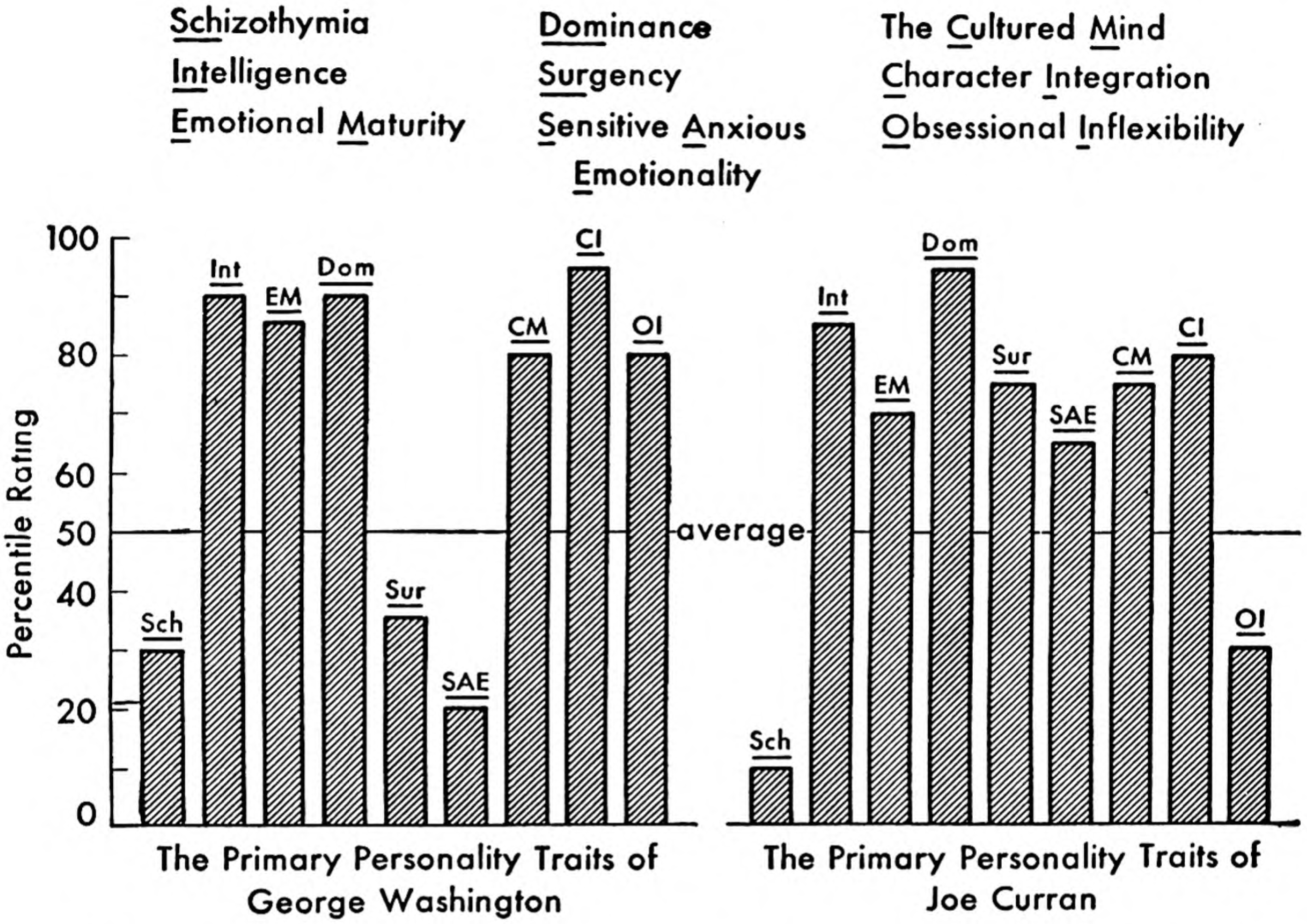

Fig. 120. Ratings of two adults on nine personality traits. The traits, taken from Cattell, are described in the text. The ratings were made from published character sketches and thus cannot be highly accurate. How could better ratings be obtained?

1. Is persevering and stable
2. Is very particular about dress and personal property
3. Is able to concentrate well
4. Does not relax easily

As far as mental health goes, one extreme is as bad as the other, for people with very high scores are inclined toward obsessions and phobias (see page 428), whereas those with very low scores tend to-

ward neurasthenia. Most people, to be sure, cluster near the middle of the scale.

Though everyone will agree that these nine traits are important to the description of personality, it is easy to say that there are others which also bulk large in the picture. Further research will no doubt add to this list, and reshuffle these a little.

Just as an exercise in defining traits and analyzing personality, the reader might try his hand at rating our familiar friends, G. Washington and J. Curran, in respect to these nine primary traits. The sketches are, of course, inadequate for this purpose, but the effort will be rewarding. Some of these traits, such as intelligence and dominance, can be tested objectively. [Incidentally, Terman's estimate of Washington's intelligence, arrived at by the method mentioned in the preceding chapter (see page 354), agrees quite well with Jefferson's judgment.] The author's ratings of these two gentlemen are pictured in Fig. 120. The reader can compare his own with these.

## METHODS OF PERSONALITY INVESTIGATION

A human personality is one of the most complex objects of study that the scientific method has ever encountered. Students of the psychology of personality have been forced to use many of the methods of the other arts and sciences, and to invent a few new ones. Roughly, the methods can be grouped in four large classes: objective observation, ratings by others, self-description, and depth methods.

**Objective observation.** Certainly the most valid way of investigating personality is actually to watch what people do, all day long, every day. The best index to life is life itself. Following this conviction, psychologists have watched children in school and at recess, counting the number of fights, smiles, expressions of sympathy, and so on, per hour for each child. Others have climbed into the cockpit to observe signs of emotion in beginning fliers. The behavior of visitors in museums, in libraries, and in waiting rooms, their mannerisms, their restlessness, and their total amount of activity, have also come in for tabulation.

When they cannot observe their subjects in action, psychologists are satisfied with *records of behavior*, which this bureaucratic civilization provides in great abundance. Records of credit agencies, of books

bought and borrowed, of membership in political and religious organizations, and of recreational activities supply evidence for psychological research as well as for biography.

If the behavior we are looking for does not turn up often enough, we can devise experimental situations or tests and run our subjects through them. Some experimenters have shot blank cartridges behind people while a high-speed movie camera catches the facial expression. They put people to work on disagreeable tasks to see how long they will continue, as a measure of persistence. Standard tests have been invented to determine degree of suggestibility, of distractibility, and of resistance to pain. Anyone with a little ingenuity can think up situations that put a man on the spot and make him show what he does when he is frustrated, or scared, or bored, or even jealous.

***Description by others: ratings.*** When a careful observer like Thomas Jefferson writes that the strongest feature of George Washington's character was prudence, that "as far as he saw, no judgment was ever sounder," it is information to be taken seriously. There is nothing new about such ratings of character. People have always made loans, voted for officials, and signed contracts, including the marriage contract, on the basis of personal judgments of other people and predictions of their future behavior. The contribution of the psychologists is merely the refinement of a well-known method. By working out techniques for computing the reliability of ratings of personality, they have been able to trace the sources of error and thus to step up the accuracy of the ratings.

The principles of judging personality, derived from years of psychological research, have been profitable to employment managers evaluating a man's worth to the organization and also to psychologists who need the judgments for further research. But these principles are of equal value to any honest man who is at all critical about the opinions he hears expressed in the barbershop or who feels a sense of responsibility for his own statements about his fellow men.

All rating schemes are the same in that they all depend on one person's judgment of another, but these judgments may be communicated to a third party in a variety of ways. Simple declarative statements are made. "Greenspan is a sour cuss." "Old King Cole is a merry old soul." Jefferson's letter is largely composed of this sort of straightforward evaluation. Now everyone is merry once in a while,

but since the poet took the initiative in calling the king merry, the ordinary reader, familiar with this little trick of our language, assumes that the king's behavior is distinguished in this respect, that he is consistently merrier than the average. So all goes well.

Biographers like to select their subject's outstanding characteristic for description, passing over those in which he differs from others only in slight degree. Then they often try to distill this individual trait into a pungent descriptive phrase. Gamaliel Bradford in *The Quick and the Dead* uses these phrases as titles for his literary psychographs.

The Fury of Living: Theodore Roosevelt
The World as Idea: Nikolai Lenin
The World as Will: Benito Mussolini
The Genius of the Average: Calvin Coolidge

Psychologists like to work in a more systematic fashion. They usually list a number of traits and ask their raters to rate the subject on each one. The rater may merely make a check indicating that Stone is or is not industrious, shrewd, dependable, sociable, and so on. This either-or judgment is unsatisfactory under many conditions, however, so more often a scale of some sort is used. The rater can call Stone very sociable, sociable, of average sociability, unsociable, or very unsociable. For clerical reasons it is convenient to arrange the degrees of the trait on a line, as follows:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sociability: | Low | | | | | | High |
| Dependability: | Low | | | | | | High |
| Industriousness: | Low | | | | | | High |

Some investigators like to use numbers, as follows:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sociability: | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Dependability: | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Industriousness: | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

In fact much ingenuity and salesmanship has been exerted in the design of rating scales and the sheets of paper on which they are printed. But the difference between good ratings and bad is not the appearance

of the sheets on which they are made, but the psychology behind them. With this introduction, the psychology behind judgments of personality can now be set out in the form of a few simple principles so that any conscientious judge of his fellow men and women can take notice.

*Principle* 1. *Accuracy increases when the trait to be rated is precisely defined.* This is an obvious point, but it still is disturbing to note how often two people commenting, and disagreeing, on Mrs. De Giacomo's sincerity are talking about different aspects of her behavior, talking past each other in effect. Similarly, when the ratings are communicated to a third party, they will be more useful if the third party has the same definition in mind that the rater used.

*Principle* 2. *Accuracy increases when the scale on which the ratings are indicated is defined.* If numbers such as 1 to 7 are used, the raters and all using the ratings must understand what the numbers mean. Usually the middle number, in this case 4, means the average amount of the trait, 5 and 3 mean a little above and a little below the average, and so on. But the average of what? It makes a difference whether one is talking about the average of the general population, or of a special group of salesmen, or of machinists. Some of the disagreement between two judges of the same person vanishes when this principle is kept in mind. When Jefferson writes that Washington's "mind was great and powerful, without being of the very first order," he exhibits a nice sense of the quantitative, but he loses it as his characterization continues. When he says that Washington was embarrassed when called on for a sudden opinion, is he comparing him to Americans in general or to public speakers? [When objective tests are used, this problem of supplying a satisfactory frame of reference is solved by the use of norms (see page 299).]

*Principle* 3. *Accuracy decreases when judgments of good and bad creep into the description.* There is nothing wrong with these moral judgments if moral judgments are desired. The trouble is that ratings of good and bad are so much fun, and so easy to make. When judgment of some neutral characteristic is desired, moral censure and praise have a way of squeezing in and distorting the rating, especially if the rating is difficult. It is difficult, for example, to decide whether Kroll is "industrious" or "very industrious," so, if the rater likes Kroll, he is that much more likely to check "very industrious." Or, conscious

of his own feelings, he may lean over backward and deliberately lower his rating. The character sketch by Jefferson at the beginning of this chapter is clearly an attempt at a judicious weighing of Washington's good points and bad, in the tradition of the times. Boyer's profile of Joe Curran, which is a good example of modern character writing at its best, illustrates *The New Yorker's* custom of describing the subject from many angles, as he does many specific things, and eschewing praise and blame, so that neutral description bulks large and moral censure that much smaller. This is the reason, of course, that campaign biographies are practically worthless.

There are several ways of discounting this type of error. Merely being aware of the possibility of error and trying hard to avoid it helps considerably. A more positive aid is to develop an interest in personality. To the extent that a judge of personality gets intrigued by the structure of his subject's personality, for its own sake, his preoccupation with external evaluations decreases. The shrewd propagandist begins in a neutral tone, then, after gaining the reader's confidence, insidiously works in his eulogy or condemnation. Where personalities are concerned, the reader or listener can never relax his vigilance.

When ratings are made systematically, a recently invented technique, called the *forced-choice method,* promises to reduce this error considerably. The essence of the trick consists in forcing the rater to choose between two descriptive phrases which are equally complimentary or equally uncomplimentary. Two sample questions will make the technique clear:

1. Which phrase describes him better? (*a*) A hard worker; (*b*) a keen sense of humor.
2. Which phrase describes him better? (*a*) Selfish; (*b*) conceited.

If one phrase is as complimentary as the other, the complimentary aspects will cancel each other, so the neutral descriptive aspects will be emphasized. The only problem is to write phrases that are equally complimentary or uncomplimentary, yet still descriptive of personality. This is not a matter of fancy writing but of empirical analysis, and the detailed statistical work involved has already been carried out by the Personnel Research Section of the Adjutant General's Office in order to improve ratings of military and civilian personnel of the

War Department. It is an inhuman trick, like forcing the rater to choose between arsenic and strangulation, but such are the lengths to which science must go in order to discount human emotions and utilize human intelligence.

*Principle* 4. *Ratings are usually made on the basis of the general impression.* The human tendency to see things, especially people, as all white or all black is behind this principle. So also is the tendency to put people into types, or stereotypes (see page 259), such as the executive type, a typical politician, the criminal type, and so on, then to endow these people with all the imagined characteristics of the type. Brief contact with a man or woman, a look at his face, a mental note of his movements, the sound of his voice, and perhaps some attention to what he says and does, are enough to generate an impression of his personality. It is astonishing to contemplate how quickly such a general impression is formed. (But it should not astonish those who are familiar with the psychology of perception.) Then, once this general impression is established, separate traits are perceived within the overall pattern. Whatever the reason may be, this *halo effect,* this tendency to rate a person high in all traits, or low in all traits, is a common one, which confuses many otherwise useful ratings. Arranging to rate several people on one trait at a time is a preventive.

*Principle* 5. *Some traits are more accurately rated than others.* Since rating is a social process, one might expect that those superficial traits which show up in social interaction would be the easiest to judge. Research in this country and in England has verified this expectation. Sociability, assertiveness, submissiveness, general emotionality, talkativeness, cheerfulness, level of activity, and similar outward traits are the ones which can be rated with the most reliability. Traits that people cover up and those that are not regularly displayed in social intercourse, like vanity, cannot be judged so readily.

*Principle* 6. *Some judges are better than others.* The good judge of personality must be intelligent because he is dealing with abstract generalizations from specific instances. He or she must have had some experience in meeting, talking to, drawing out, and checking up on a wide variety of people. (And he may still be fooled by people who fall outside the range he is used to.) He must be interested in people *for their own sakes.* Many people are interested in other people for the sake of selling them something, telling them a story, or using them

to illustrate a theory. But the ideal judge of character is fascinated by people per se, by their goals, their fears, and their ways of meeting life or hiding from it.

*Principle* 7. *Ratings improve with training.* The best kind of training is that which gives the judge an opportunity to check up on his judgments, by comparing them either with objective evidence or with the judgments of others. In this way the most flagrant errors are eliminated. The judge learns, for example, to overlook things that do not correspond with behavior, like appearance and names, and to look for useful signs, like characteristic movements, indicators of tension, changes in pitch of the voice, clues to motivations and emotions, and marks of interest in one topic rather than another. When personnel psychologists undertake to improve merit ratings in large industrial and government organizations, they find that short training courses for supervisors and foremen, clarifying the principles listed here, do actually improve the accuracy of the ratings. Experiments in teaching fraternity brothers to rate each other have given good results. And, best of all, when people do look at their fellow men and women seriously, they enjoy it.

***Self-description.*** It is well known that people like to talk about themselves. A few casual questions—perhaps no more than a rhetorical one like "How do you do?"—will start anyone, with few exceptions, off on a recital of frustrations, recollections of childhood, faults, amours, and the strange lack of appreciation of one's merits. When given the opportunity, high-school and college students eagerly write essays about themselves, by such titles as "A Case History of T . . . S . . ." Adults are more reticent, but personal letters, memoirs, diaries, and journals do sometimes come to the light of day. Autobiographies come out every year, most of them superficial, some, like *Mein Kampf,* personal documents of rare psychological and historical significance.

Whatever the reason for writing, whether exhibitionism, self-justification, self-punishment, or a purely intellectual urge to look back over the road once traveled, these personal documents are seldom dull. When taken critically, sifted, and analyzed, they yield a goodly grist of information about the writers. Skilled analysts can go over such materials and rate the authors on common traits, like religious beliefs, sources of happiness and unhappiness, social and political atti-

tudes, and level of aspirations. The analysts, to be sure, do not believe everything the writer says. But they take the writer's statements as valid bits of scientific data, to be examined and evaluated alongside the rest of the document. Under optimum conditions, when the material is reasonably complete and spontaneous, and two or more analysts, working within the same frame of reference, agree with each other, the information obtained can be accepted as accurate.

There is a good deal to be learned about personality from reading autobiographies, with entertainment as a bonus more often than not. H. G. Wells' *Experiment in Autobiography* is an excellent starting place, because the author is skillful, almost scientifically motivated, and critical. Those by Helen Keller, Benvenuto Cellini, and Richard Wright add variety. Leonard's *Locomotive God* is a special and illuminating case. A delinquent boy's own story has been edited by the sociologist, Clifford Shaw, under the title *The Jackroller*. Paul Radin, the anthropologist, has translated into English the autobiography of Crashing Thunder, originally written in the native Winnebago. Special enjoyment, for the more serious students of personality, comes from the comparison of autobiography and biography: Hitler's *Mein Kampf* with Heiden's *Der Führer*, Franklin's *Autobiography* with Van Doren's *Franklin*, and Barnum's *Trials and Tribulations* with Werner's *Barnum*.

When psychologists discovered, during the First World War, that intelligence tests could be given to large groups, they tried to devise group tests along the same line for personality traits. The first one, dealing with emotional stability, was made up merely by setting down on paper questions that psychiatrists commonly asked their patients orally.

Do you have bad dreams?
Do you feel that someone is watching you?
Do you often feel miserable without knowing why?

In the past 25 years, tests of emotionality have been refined and tests of other traits have been developed. They go by such names as "personality tests," "questionnaires," "schedules," and even "paper-and-pencil tests" to distinguish them from the objective tests of behavior mentioned above. Some ask questions about habitual conduct in social interaction.

Do you usually take the lead in directing the course of a conversation?
If a merchant charges illegal prices, do you feel embarrassed about challenging him?
Would you rather apply for a job by letter or in person?
Which is more important to you, being true to your ideals, or being loyal to your friends?

The first two might be found on a test of dominance or assertiveness. The second two are typical of items on tests of extroversion, as opposed to introversion. Tests of this kind have been constructed for sociability, self-confidence, persistence, punctuality, and dozens of other traits. They are very convenient since they can be given to large numbers of people at once and can be scored by anyone with a little training, or even by a machine. They have been used by the experts for research on personality. For practical purposes, as in the selection of employees, these paper-and-pencil tests are still in the experimental stage.

More clear-cut than such tests are tests of interests and attitudes, also of the paper-and-pencil variety. Interest tests ask questions about preferences for various business activities, kinds of people, reading matter, and recreations. They have demonstrated their usefulness in vocational guidance and to a limited degree in vocational selection. (Some results of one interest test are illustrated on page 379.) They can be scored so as to give a percentile score in common fields of interests, such as mechanical, scientific, artistic, religious, theoretical, and so on, or they can be scored so that amount of agreement with the interests of certain occupational groups is indicated. The well-known Strong Vocational Interest Blank, for example, can be scored so that if a woman's interests are similar to those of professional nurses, she will get an A on the nurse scale. The theory is that, if her interests are similar to the interests of practicing nurses and she becomes a nurse, she has that much better chance of being happy on the job. It can be thus scored for 18 jobs for women and 34 jobs for men.

Another kind of test that has been quite successful is the test of attitude or opinion on economic and political issues. Many questions about an idea or program are asked in such a way that the scores will indicate "pro" and "anti" feelings. A test of attitude toward the United Nations might ask for agreement or disagreement with these statements.

1. UN is a waste of time and effort.
2. UN is our only hope for permanent peace.
3. The present UN is better than nothing.
4. It is better to yield some of our sovereignty to UN than to risk future war.
5. UN is part of a plot to overthrow the U. S.
6. Membership in UN is likely to drag us into war.

The responses to 20 or 30 carefully processed statements of this sort describe one aspect of the respondent's personality by locating his position on a scale that runs all the way from the "anti" end to the "pro" end. To paint a well-rounded picture of anyone's personality, it is helpful to know his position on the controversial issues of politics, religion, and the like. Such tests for accurate measurement of one individual's opinions, along with polls of the public's opinions, are responsible for most of the information about attitudes contained in the preceding chapters.

**Depth methods.** These three methods, direct observation of behavior, ratings by others, and self-description, are straightforward procedures which, when properly used, yield a reasonably accurate picture of the personality. But it is often a superficial picture, which does not include the deeper, unconscious motives and emotions that the subject either cannot or will not disclose. Baffled by the masks most people hide behind, psychologists have often envied the surgeon who, with a few neat strokes of the scalpel, can turn back the protective epidermis and expose the vital organs beneath. The methods of the psychological sciences are less like those of the surgeon, however, and more like those of the geophysicist trying to construct a picture of the interior of the earth. The geophysicist cannot penetrate into the interior for direct observation. He must work indirectly, getting all the facts he can pick up on the surface from geology, geodesy, and seismology, then combining these facts into an imaginative or inferential description of what goes on below.

One of the oldest indirect methods for plumbing the depths of personality, below the forbidding crust of consciousness, is dream analysis by free association. It is the classic method of the psychoanalyst, who is not particularly interested in the patient's dreams but uses them, together with daytime fantasies, as a tunnel into his emotional life. The patient reclines in a relaxed position, preferably on a couch

in a darkened room, and recites his dreams. Then the analyst asks for associations with specific images in the dream. "What occurs to you in connection with this dream? or this voyage?" The cardinal rule of dream analysis is that the patient must express *everything* that comes to mind. This the unpracticed patient is unable to do, because so many things come to mind that are ordinarily unmentionable. But with the encouragement of the analyst, he soon learns to tell all. Since the more significant dreams, especially the recurrent dreams, are related in some way to a persistent motive (see Chap. 6), sooner or later the conversation comes round to the patient's unconscious wishes and fears. The analyst notes all this and, if he is well trained and skillful, can estimate the deeper motivations in the patient's life. Of especial significance are signs of blocking. Something is said, then covered up by a change in the direction of the associations, or by giggling, delay, or other evidence of embarrassment. These signs supply leads, which the analyst follows up when practicable. This method takes a long time and is correspondingly expensive; just how long it takes depends upon the shrewdness of the analyst, the patient's speed in overcoming his resistance to this display of his inner self, and the development of an emotional transfer to the analyst.

Obviously this is not an objective scientific technique of personality analysis. It requires bold inference on the part of the analyst from the materials supplied by the patient. "Success remains," in Freud's words, "a matter of ingenious conjecture, of direct intuition, and for this reason dream interpretation has naturally been elevated into an art which seems to depend upon extraordinary gifts." Recent research has given evidence of internal consistency in a cycle of dreams.[7] Partial validation is furnished by the fact that *some* of Freud's early assumptions about childhood sexuality, developed from analysis of adults' dreams, have been verified by direct observation of children.[8]

A few years ago a Swiss psychiatrist, Dr. Herman Rorschach, put together an ink-blot test to aid in the diagnosis of his mental patients. This test is based on a principle of perception, discussed on page 110, which states that when the perceptual field is vague or ambiguous, what one sees there is likely to be a projection of his own expectations, hopes, and fears. What Rorschach and his followers in this country have done is to center their attention on a set of 10 provoca-

tive ink blots, called the *Rorschach test,* building up their experience to the point where now they can work the principle in reverse. They begin with the responses of a person looking at the ink blots, such as the one on page 110, and from these they construct a picture of his inner world of hopes and fears, and his manner of putting these drives into action. The kind of interpretation made by an expert Rorschacher, Dr. S. J. Beck, head psychologist of the Michael Reese Hospital in Chicago, is illustrated by the following paragraphs.[9] (The subject of the description was a hospital porter, age fifty-five.)

> The immediately striking fact is the extremely limited horizon of this man, seen in his very narrow associational content. . . . Consistent with this limitation are his low functioning intelligence, his comparative indifference to the larger scene, with slightly excessive attention to the obvious, and his low total productivity. His mental furniture is highly stereotyped. . . . The pattern thus appears to follow that of the feebleminded.
>
> There is, however, one critical discrepancy in this picture: the grip on reality is not consistent with mental deficiency. On the contrary, S manifests a habitual accuracy even above the average adult, disclosing more than usual caution in his attitude vis-à-vis the world. Within his limited field, his self-respect is high enough for him to refuse to deviate from the straight path of actual functioning. The man has a strong ego.
>
> The pattern therefore becomes clear as that of a person of restricted mental field but not feebleminded. Errors of judgment need not be expected. . . .
>
> The inner life of S is as restricted as the intellectual: there is no imaginative activity and only a single overt expression of feeling. Warm social contact is lacking. The affective experience that the test does uncover is at the level of the unstable; irritability may be expected. But the low total amount of liveliness is assurance against any disturbed behavior.
>
> In conclusion, therefore, we have a simple but apparently self-respecting individual, one whose interests and field of achievement are narrow indeed. But within this range he is entirely dependable.

All this from the responses to 10 ink blots!

Operating on the same principle, a number of other shrewd devices have been invented as part of the effort to uncover the hidden aspects of personality. For children, dolls are convenient because the children will often use the dolls to act out their conflicts with parents and other children, even though they will not openly talk about them. Adults

respond quite well to dramatic pictures and incomplete stories, which act as launching platforms for the projection of their wishes and anxieties.

> A drably dressed woman of about forty-five was walking down the street toward the park with a stylishly dressed girl in her teens. As they were about to cross the road, the girl suddenly stopped and turned back. The older woman stopped also, looked back at the girl, then . . .

You finish the story.

These ingenious schemes are often called *projective methods*, because in all of them the stimulus material is incomplete or ambiguous, giving the subject of the analysis a chance to project himself into the story. The examiner, if he is skillful and experienced, can reverse the process, working from what the subject says and does back to what he hopes and fears. No general statement can be made about the dependability of these depth methods, for the accuracy depends, not on the method, but upon the skill of the examiner and the adequacy of the material the subject gives him for analysis. Beginners do poorly. Some experts, under the best conditions, get surprisingly accurate results.

***Evaluation of methods, combinations.*** Since a human personality is such an elusive thing to catch hold of, it is very easy to make errors. For this reason critical students of personality examine their methods seriously, as all scientists do. Actual observation of a person's behavior, counting and timing his activities, either in a real-life situation or in a laboratory test situation, is no doubt the most valid method. Ratings of people by others on the basis of memory and evaluation of past observation stand next in validity. Self-description is the least valid of these three methods for it depends upon accurate memory, insight into one's own personality, and above all, sympathy with the purpose of the examination.

But validity is not all we want. We want comprehensive methods, of wide scope, which include as much of the complexity of personality as possible. From this standpoint the rank of these three methods is reversed. Self-description is the broadest, for most people can be induced, with proper encouragement, to describe, or at least talk about, almost anything they have done or thought of. Ratings by others are less comprehensive, because others may not have observed the sub-

ject's behavior at the significant moments of his life. Actual observation of behavior is the narrowest method, for practical reasons. It is very difficult to arrange to observe people when they are highly motivated, when they are making important decisions, when they are doing things they will later be ashamed of, and the like. This objective method is more convenient, however, in the study of children's personalities.

The best procedure, of course, is to combine several methods. It is a good rule in science, and in logic in general, that the greater the amount of inference from the facts, the more important becomes the necessity of checking these inferences by other facts and other methods. In the manner of the geophysicists, piecing together a plausible picture of the interior of the earth, the experts like to use several methods on the same subjects and check one against the other. Psychologists did not feel sure of verbal tests of dominance until they had learned that the scores on these tests would actually predict how people would act when they were brought into the laboratory and put through a special routine designed for the observation of dominance behavior. Some interest tests are known to be useful because the scores from them agree with the way people spend their time and with their range of information on various topics. Personality tests intended for the selection of employees are not considered valid until it is proved that good employees do get higher scores than poor ones.

The *interview method* is really a combination of several of these methods. The interviewer gets certain objective data from the subject, such as his age, place of birth, occupation, and education. The subject may describe himself more fully, talking about his motives and emotions, and his problems. During the interview the interviewer has the opportunity to rate the subject as to tenseness, emotionality, sociability, and the like. And the interviewer may employ one of the depth methods, using the subject's words and actions as a guide to the reconstruction of his inner life of hopes and fears.

A large part of the efforts of the critical students of personality today is devoted to the appraisal of these different methods of studying the subject, checking one against another, trying to eliminate inaccuracies and to build up a system or combination of methods that will yield an all-round life-size portrait of the individual.

## THE ORIGINS OF PERSONALITY

The time has now come to ask about the origin of specific personality traits. What makes one woman frugal and another prodigal? Why does Mr. Stone vote Independent and Mrs. De Giacomo vote Republican, while Miss Eisner has her hair done on Election Day? Whence come the great variations in an apparently simple characteristic like total amount of activity per day?

Personalities, like oak trees, take shape slowly. To follow the development of 100 personalities from cradle to grave will require the cooperative efforts of two or three generations of psychologists. Several cooperative long-time research projects of this sort are now under way. Children are being observed at their mothers' breasts, at play, and at school. Their ratings and test scores are filed away, like the time capsule under the World's Fair site, so that comparisons between adult personality and early experiences can be made 20 or 40 years later. Since the psychology of personality itself is so young, little has yet come from these ambitious enterprises.

While looking toward the future for these investigations to bear fruit, psychologists have also turned their eyes back, making use of the methods of the historian and the geologist to find traces in the past of the personalities of the present. Working backwards, reconstructing childhood and youth from adult reminiscences, is never very satisfactory. Even tree rings furnish a more dependable record of growing pains than an adult's recollections. It is usually impossible, for one thing, to disentangle the influence of family experiences from the influence of heredity. Schizophrenic parents give their children schizophrenic constitutions as well as schizophrenic family life. In spite of these difficulties, the past has been made to give up a few of its secrets. Anthropologists have broadened the base of the science by describing personalities that have developed in very different cultures. Best of all, in a few cases, experimenters have been able actually to modify personality traits by special training. Put all these research techniques together, and the progress of this very young science in its search for the headwaters of personality looks quite impressive.

***Constitutional factors in personality.*** One should never forget that man is an animal. "A bloody birth and a worm-infested grave," as

Irwin Edman once put it, "bound the career of even the most cogent dialectician." All through this book biology and culture can be seen working together to produce the personalities who do the common and the uncommon things that make up their daily lives. When we ask why one personality is so different from another, the answer is to be found, in part, in the biological constitution of the individual, which comes to him largely as a gift from his ancestors, tax-free.

*The influence of heredity.* To begin with a simple case, the difference in "nervousness" between two animal species, like cows and sparrows, must be a hereditary difference. Some babies consistently cry more than others, and some laugh more than others, almost from the very beginning. As further evidence for the inheritance of one aspect of personality, several scientists have bred rats selectively, the way race horses and prize cattle are bred, and have succeeded in producing two distinct strains, one highly emotional, the other quite calm.[10] (The test for emotionality is the frequency of urinating and defecating in strange surroundings.)

The parallel experiment with human beings cannot be done, outside the pages of the comic strips or an Aldous Huxley novel, but the next best thing is a comparison of identical twins who have been brought up in different family environments.

Dr. Barbara Burks discovered such a pair of twins, identical in heredity, who had been separated when they were 2 weeks old and adopted into different families. The family that adopted Adelaide (twin A) moved away, but she and Beatrice (twin B) occasionally met. Adelaide traveled widely up to teen age; consequently her schooling in these years was irregular. Her foster parents believed in and practiced strict discipline. Beatrice's residence, in contrast, was quite stable, and she enjoyed a milder sort of discipline, constant companionship with both foster parents, and effective guidance from one of her high-school teachers. She was ill for 6 months, however, during her fifth year. Dr. Burks observed and tested these girls several times up to age eighteen in order to see what personality differences these environmental differences would produce.[11]

Although they were educated in different schools, their handwriting was quite similar. Speed of writing was almost identical. Their careers were similar up to age twelve in respect to nail biting, enuresis, and early puberty. They were alike in mannerisms such as walking and

shaking hands. At summer camp their leaders rated them about the same in physical vitality, irritability, and a tendency to be dissatisfied. The chief difference was noted in social-emotional traits, for Beatrice, whose home situation contained less pressure, was more cheerful, and showed greater warmth and skill in social relationships. Despite differences in home and school background, their vocational interests at age eighteen were similar.

This sort of evidence, though it comes from only one pair of twins, shows the kind of traits in which heredity can be expected to be strongest. The difference in cheerfulness and in social relations, produced by the different environments, must also be taken seriously. A similar extreme contrast was noticed in the separated identical twins mentioned in the previous chapter (page 345); the one with little education was ill at ease, while the other was poised.[12] The family origin of such traits will be traced in the next section.

*Physique and temperament.* Although it is very difficult to disentangle the effects of heredity from those of the environment in the formation of personality, it is fairly easy to compare many characteristics of personality with constitutional factors, like body type, which are known to be hereditary. The first attempts of this sort, looking toward a connection between constitution and personality, were crude comparisons of some obvious physical feature and some personality trait. Blonds were compared with brunets. Tall people were compared with short people. Long heads were compared with wide heads. The outcome of all this has been disappointing. If there are any such simple relationships, they have not yet been proved. The attractive young lady with the cheerful lilt to her mouth, who looks as if she were about to break into a smile, may actually smile oftener than the average young lady, but then she may not. Perhaps her mouth is built that way. Or it may be a trick in the way the lipstick is applied. The wise judge of character will not depend on facial appearances, but will wait until he sees the smile.

These facts are well known, yet many writers, when describing someone, refer to "an honest face," "laughing eyes," or "an impertinent nose." If the observations of these writers are at all worth while, they are based on facial movements, signs of muscle tension, and gestures, not on the structure of the face. But usually such evaluations are fastened on the face *after* they have been derived from other sources.

It is the same psychology of perception, explained in Chap. 6, which gives a tombstone a solemn mien and a clown's costume an expression of laughter.

No one can be sure that if the right body measurement is compared with the right personality trait, nothing will ever come of it. But it is true that most sophisticated psychologists and physiologists have dropped the search for simple correlations of this sort and have turned to the investigation of more subtle biological factors.

*Biochemical factors in personality.* Chapter 1 pointed out briefly how the specific and necessary contributions of each of the many chemical substances in the blood stream and the many groups of nerve cells throughout the body dovetail precisely to generate the smoothly integrated behavior of normal human beings. Naturally one would expect that variations from one person to another in the production of these biochemicals and in the excitability of these nerve cells would lead to variations in temperament. Researchers in physiology, endocrinology, neurology, biochemistry, physiological psychology, and psychosomatic medicine have in certain cases been able to verify this expectation. A general temperamental trait like amount of daily activity, or rate of energy output is affected by the secretions of the thyroid and adrenal glands, by the amount of sugar in the blood, and by certain dietary deficiencies. The amount of emotionality shown by different people may be influenced by the presence of pain in any form, the excitability of the autonomic nervous system and its rate of recovery, and the availability of bodily energy for emotional discharge.

The influence of the thyroid gland on behavior is now well known among educated people. *Hyperthyroid* cases, with their basic bodily activities, or metabolism, speeded up by the action of an abundance of thyroid secretion in the blood, are characteristically excitable, hyperactive, and apprehensive. *Hypothyroids,* with their metabolism bogged down to the point where they actually use less oxygen than normal people, are typically slow, stupid, and careless. Both types of thyroid disorder can be treated by endocrine therapy or surgery with a high probability of recovery, and with recovery comes a dramatic return in many cases to the previous personality.

The importance of the sex glands for personality is easily demonstrated in animals when these glands are removed by *castration.* A

castrated male fowl loses his male characteristics, becomes fatter, and makes delightful eating. Human beings castrated before puberty, usually by accident, or surgical necessity, change their personalities in a similar way. Castrated boys, called "eunuchs," grow into beardless men, with high-pitched voices, and feminine body structure. Sexual capacity is absent, though being human and therefore subject to social pressure, eunuchs may attempt, or pretend, to carry through the normal male expectations.

In modern times castration is not common. More common is delayed sexual development with corresponding delay in the development of an aggressive and manly adult personality. Such cases are amenable to endocrine therapy, often with striking changes in personality. Castration after puberty does not directly produce any personality changes of consequence, and does not usually interfere with sexual capacity. Neither does the usual operation of sterilization.

In women the effects of the sex glands on personality are more or less parallel. Girls who have menstruated are more mature in their interests than girls of the same age and social background who have not menstruated. This difference in maturity of interests is partly a constitutional and partly a social influence, since the onset of menstruation is a dramatic event, which underscores the girl's transition to the adult role. The social effects are more variable than the glandular effects, depending on the girl's preparation, social contacts, and goals in life. Personality changes occurring at the menopause are more gradual, but show the same combination of constitutional and social influences.

*Hermaphrodites*, who have some constitutional features of both sexes, are very rare. One pseudo hermaphrodite was considered a girl at birth, dressed as a girl, and brought up in a feminine way. But she was a tomboy at heart, who preferred baseball to sewing. When her (or his) beard became embarrassing, medical examination changed the diagnosis. Despite acceptance of his role as a girl, and training as a girl, he developed masculine interests, told the physicians that he would rather be a boy, and when tested on a variety of personality tests, scored nearer to the average male than to the average female. In this one case, the only one studied so thoroughly with objective comparison with male and female norms, the constitutional forces broke through the years of feminine social conditioning.[13]

It would be easy to exaggerate the importance of constitutional factors in personality, especially if one were sitting in the waiting room of a clinic for endocrine disorders. These medical cases make fascinating reading, but when one leaves the clinic to go out and walk among healthy men and women, the significance of biochemical and neurological factors dwindles considerably. It is true that hyperthyroids are usually hyperactive, but most hyperactive people are not hyperthyroid. In fact when normal people of above-average activity level are compared to those of below-average activity in respect to metabolic rate, which is a measure of thyroid function, no difference is found. It is true also that hermaphrodites are prone to homosexuality, but hermaphrodites are extremely rare. Among homosexuals, 95 per cent are no different constitutionally from their more orthodox neighbors, as far as present tests can detect.

The only logical conclusion is that within the normal range of variation, constitutional factors do not bulk large in the production of personality differences. For the normal 95 per cent, glandular and other constitutional considerations are outweighed by social and ego factors. Girls of masculine body type may strive intensively toward a graceful feminine role. Temperamentally overactive children may have their temperament knocked out of them. It is only when these bodily motors go berserk that they are able to overcome social habits and run the show their own way. The psychology of the normal and that of the abnormal are similar in many respects, but this is one of the differences.

Though it may seem paradoxical that constitutional forces are so strong in the disordered constitution, but not in the healthy one, there is a close analogy in the regulation of the temperature of the body. When a person has a fever, the doctor orders rest in bed because, among other reasons, body temperature is directly affected by exercise. In the healthy person, however, exercise does not raise temperature because the normally functioning body can handle it. This is only one of the paradoxes that anyone who wishes to understand personality must encompass.

*Intelligence.* General intelligence, which is a property of the nervous tissue, exerts its influence on personality in a less dramatic but more thoroughgoing fashion than the glands. The most intelligent quarter of the population lives in a psychologically different world from that

of the least intelligent quarter. They can take in more facts at one time, and they interpret the facts differently. They are more critical, or less suggestible. They can and do absorb more education, and their interests are consequently more intellectual. They solve their problems, including their personal problems, more rationally. Of the known constitutional factors in personality this one is the most important for normal people.

**Direct effects of training by parents and others.** It is universally agreed that a good share of the adult personality is shaped by parental training of the child. The search for causes of the difference between one adult and another turns logically to differences in the training each received. First, one might ask about the effectiveness of the training given the child, for some parents do succeed in putting over a fair percentage of what they attempt to teach, and others fail almost completely. The principles of learning, as set forth in Chap. 7, apply here as elsewhere, but a few special features of learning come into operation when close family relationships are involved. The child is more likely to absorb the character traits his parents are trying to teach him, if the parents are consistent by themselves and between themselves, if they understand their offspring's motives and appeal to them, and if there is a warm, mutually trusting relationship between parents and child. Since most children, and nearly all adolescents, can detect hypocrisy easily, parents teach best what they thoroughly believe, what is part of their own personalities, in contrast to something read out of a book and believed only halfheartedly.

One of the principal tasks of the growing boy or girl is the development of a strong ego that can handle the inhibitions necessary in a world of social conventions, fresh paint, and anxious parents. Those adults with dependable ego resources seem to be those who, when young, were blessed with a secure position in the family constellation and a respected parent, usually the parent of the same sex, whom they could identify with and model after (see page 151). When a boy has to inhibit his mad dash for the outdoors to sit down and put on his rubbers, it is easier for him when, in so doing, he is becoming more like his hero. In this light the advice of the child psychologists to punish the act and not the child makes sense. There is a genuine permanent difference between training that the child interprets as rejec-

tion by the parents and training that puts child and parents together against the misdeed.

It is a dim awareness of this principle that punishment by outsiders has a different meaning from punishment by parents that has led to the popularity of the Santa Claus myth. "Let some outsider handle the rewards and punishments. Then my children will absolve me of blame." In several American Indian tribes, punishment is carried out by masked dancers, secretly called in by the parents, a device that permits the parents to appear on the children's side and plead for leniency.

When psychologists divide people up into the well-adjusted and the maladjusted and ask about their childhoods, there are always more among the former who remember their parents as companionable people who gave them an opportunity for responsibility. More of the well-adjusted grew up under a guidance type of discipline than under a rigid discipline, or no discipline at all.

An experiment at the Harvard Psychological Clinic by Donald MacKinnon [14] illustrates how the childhood training shows up in adult life. Young men were surreptitiously observed while they worked problems under conditions that allowed them to cheat. When asked about childhood training, the majority of the cheaters reported that their parents had used physical punishment, whereas those who did not cheat talked in terms of respect for parents' ideals. Interestingly enough, those who inhibited their urge to look at the answers reported more guilt feelings than the uninhibited. They fidgeted, picked their noses, and sucked their thumbs more than the cheaters, who apparently violated the rules as a matter of course and in good cheer.

Some very interesting experiments in the direct training of dominance have been performed at the Iowa Child Welfare Research Station.[15] The experimenters first rated children in nursery school by observing each at play with another child of the same age, noting who got the toys in the sandbox, who bossed the other, and who defended his own possessions. Then they took those children of low and medium dominance and trained them, having them make designs with blocks, put picture puzzles together, learn stories in a picture book, and perform other tricks of this kind, then paired them again with other children. The experiments worked. Specific training with the objects and techniques involved in the social situation increased dominance

and confidence in the social situation, by increasing the child's resources.

Similar experiments have been performed in an attempt to modify children's reactions to failure.[16] The experimenters picked out 15 children who were immature on the first test, immature in the sense of giving up, being depressed by failure, requesting help unduly, destroying things, and making excuses, and trained them by starting on easy problems, working up gradually to hard problems. Then, when they tested them again, none of them cried or sulked at failure, and the degree of interest and genuine thoughtful effort had increased considerably.

These are actual experiments on the personalities of living human beings, not rubber trees, not even rats, but scientific controlled experiments with clear-cut results. They prove that direct training can change people, and suggest that differences between adults come in part from differences in opportunity for such experiences when young.

Since these experiments are so neat and clear-cut in execution and in conclusion, one is tempted to carry the conclusions too far. They do not, for example, permit the generalization that the more dominant, self-confident people are those with the most skill. There is, in fact, little relation among people between their ability and their self-confidence. Any admiral can talk down the average nuclear physicist on the subject of atomic energy. Information, skill, and ability are only one side of the problem of self-assurance; the other side will be turned up soon.

*What children are taught.* Granting then, in the case of Mrs. De Giacomo, that some part of her personality was formed by the training she received from her parents, if we want to account for the differences between Mrs. De Giacomo and her neighbor, Mrs. Janssen, we must next inquire into the differences in their family training during the 15 or 20 years that each was exposed to it. What do parents *try* to teach their children? The answer to this question reaches into the heart of personality formation.

The most general answer is that all parents, and other educational agencies, try to teach the next generation the ruling values and customs of the adult culture. American parents want their children to get ahead, to be polite and friendly, to obey the laws, to be kind to ani-

mals, and to respect their parents, and so on. The dominant traits taught by the Zuñi Indians of Central America, however, are formality and inoffensiveness; getting ahead is discouraged. Children of the Dobu Islands in the western Pacific are impressed by their parents with the importance of caution in all dealings with strangers. As adults they are extremely suspicious, building roads around, instead of through, their villages. In old China and in some parts of Samoa, the ruling value is respect for the aged, for their authority, dignity, and wisdom.

But there are equally important differences in direct training within one heterogeneous culture like our own. The Lynds,[17] in their famous survey of Middletown, learned that "business-class" mothers were more "up-to-date" in stressing concentration, social-mindedness, knowledge of sex hygiene, patriotism, and independence, while "working-class" mothers, like *their* mothers, worked for strict obedience, loyalty to church, good manners, and good grades in school. To the extent that the parents' efforts are successful, personalities trained in these families can be expected to differ in these ways. Some parents encourage their children to chatter about childish things; others want them to speak their piece, then step down. Some are pleased by constructive activity, others by neatness. Some proud parents reward imaginative storytelling; others bring their offspring up to know the truth and stick to it.

Just what traits are encouraged depends upon the parents' own personalities, the books they have read, the lectures they have attended, their diagnosis of the child's needs, as well as each parent's notion of what is wrong with the other parent, and which of the two spends the most effort on the child's training. The parents' training of the child is slanted also by what they consider, perhaps unconsciously, right and wrong in their own upbringing. The man who had to work hard as a boy may be determined that his son also will learn the virtues of hard work, or he may plan that his son will enjoy the opportunities of the leisurely life he missed. A shy, socially inadequate woman may protect her daughter from the cruel world of thoughtless human beings, or she may demand that her daughter acquire more poise than her mother. When the parents' demands of the child are the result of a guilt feeling, one can look for inconsistency in training, oscillating between rigor and sentiment.

The physical environment introduces still another variable. When

the child's theater of operations takes in many breakable objects, the parents are likely to draw sharp lines between touchables and untouchables. Some children have a room of their own and some do not. There is no doubt that a youngster, who goes through his jumping, running, climbing, handspringing, digging, building, hiding-and-seeking days in a four-room apartment on the third floor, will be subject to different discipline and will grow into a different adult in some respects from one who spends these days on a 100-acre farm, or in a company-owned house in Steelville.

Of the organized agencies outside the family that exercise a deliberate influence on the character of growing boys and girls, such as churches, scouts, Hi-Y, settlement houses, athletic groups, and the like, no general statement of their effects can be made because they vary so widely. In general, their influence is in the direction of the good old-fashioned virtues wished for by the organization that puts up the money, necessarily the more conservative attitudes. Some of these agencies have well-trained staffs with good morale, but not all. Obviously their effects on children cannot be judged from the circulars sent out with their appeals for financial support, but must be judged from actual observation of changes in the behavior of the youth within their reach. It is clear, however, that when the community gets behind a well-planned, well-financed youth program and secures the help of expert personnel, real changes in the boys and girls will be observed, even in such definite ways as a reduction in delinquency rate.

***Incidental acquisitions.*** The formation of personality is not covered by listing what the parents attempt to teach their children. Children learn far more from their parents than they are taught. And they continue to pick up ideas, attitudes, prejudices, loves, and hates outside the family, in married life, on the job, and elsewhere, until their day is done. In fact, the largest fraction of the adult personality comes not from direct training but from learning of an incidental, subtle variety, called "incidental learning" in Chap. 7, through the agency of which some of the more basic traits are developed.

One of these basic traits, which appears early in life and maintains its importance as a fundamental trait, goes by such names as "liveliness," "responsiveness to stimulation," and "vitality." No doubt it is related to surgency. Its origin is partly a matter of good health and endocrine balance, but social influences play a role also, especially in

early infancy and childhood. An earlier chapter described how the unsocial vegetative infant becomes interested in the surrounding world and the people in it because in the typical case such things are useful to him in his business. Babies being as cute and unthreatening as they are, and adults being such easy prey to their charms, most babies are stimulated, tickled, fondled, and juggled. It is possible, however, to imagine an environment in which infants are not so stimulated. What would happen if an infant were properly fed but psychologically neglected, allowed to grow up without the stimulation of this handling or mothering? Here is another case in which a good controlled experiment has not been done, but the fates have supplied researchers with the next best thing. There are records [18] of infants born and reared in institutions, with adequate nutrition but without the handling of fond parents, suffering from a personality disturbance known as "hospitalism," manifested by dullness, unaggressiveness, lack of interest in the environment, lack of imagination, and lack of sociability. A few, on the other hand, become tense in a rigid, unadaptable way. Almost any kind of mothering of such children, even when done by delinquent girls, also institutionalized, improves their responsiveness to stimulation.

It is not difficult, from our knowledge of learning, to understand the relation between mothering and an interest in the environment. When an adult fondles the infant, this gives him experience in depending on other people, adjusting his behavior to theirs, and watching them adjust their acts to his. The same sort of mothering, licking, and nudging can be observed in most of the higher vertebrates. When a child can elicit skin comforts and other kinds of fun from adults by being lively, he will, if he is not dull, be lively now and then. Instead of a hostile, or at best a neutral, place, the world becomes an opportunity for excitement, sporadic gaiety, and mutual interaction. Neglected babies, who have missed this give-and-take, are less likely to be lively and entertaining. This basic attitude toward life, formulated at first contact with it, can be modified by later experiences—there are so many ways in which a trusting, openmouthed approach to life can be stunted—but the initial orientation is crucial.

A number of lines of research in recent years have pointed to *feelings of security* and insecurity as being tied up with several aspects of personality. Hence psychiatrists and psychologists have begun to

take the matter seriously. Psychological security is by nature a personal subjective thing, which can be investigated only by way of the person's report of his feelings, and in this case paper-and-pencil tests of the kind described on page 390 work fairly well. A test for getting at this characteristic, devised by A. H. Maslow[19] and his associates at Brooklyn College in New York, asks questions about such matters as worries, being able to express one's feelings, and getting a square deal out of life. Secure people feel that other people like them, that they have a safe place in this social system, and that they can handle their biological impulses. The secure child, and the secure adult as well, is more spontaneous, and for that reason makes the best use of whatever talents he is blessed with. The insecure person, walking his tightrope so cautiously, does not dare to follow his ideas or ambitions as far as they beckon.

This insecurity has been traced back to a variety of childhood experiences, for example, displacement of the child by a new arrival competing for the parents' affection, anxiety over the emergence into consciousness of parentally disapproved impulses, and even premature weaning. Because of the interest of pediatricians and psychologists in weaning problems, to say nothing of parents' interests, the relation between breast feeding and feelings of security was investigated. The experimenters[20] got 416 young adults in New York to take a test of security, then asked them to find out from their parents how they were fed in the first few months of life. The results, as shown in Fig. 121, disclose a curious and very significant state of affairs. Those who had been breast-fed a long time grew up to be secure adults, as one might expect, but so did those who had been breast-fed only a short time. (Bottle-fed children scored high for security also.) Those with the least security, or the most insecurity, were those in the middle, who had been breast-fed between 6 and 9 months.

One interpretation of this curious relationship is that babies have to develop a few months before they can appreciate the psychological significance of denial of the breast. They are not mature enough at three months to be made insecure. Another interpretation of this conundrum is that the mothers who weaned their babies early felt guilty about it, and compensated by giving them extra affection and comfort in some other way. At any rate it is not one specific item in the baby's experience that counts. It is the general atmosphere that has the long-

time effect. A world of warm and dependable people is different from a place where goods are offered, then withdrawn, where the child has to be constantly on guard.

Study of the case histories of secure and insecure adolescents and adults has disclosed a list of additional factors behind this fundamental trait. Anyone's feeling of security is increased by finding affection in social relations, making friends who value him for what he is. The boy or girl who grows into a world that fits his expectations, one in which he knows what to do and what is coming next, is off to a lucky start. Insecurity is fostered by rivalry with brothers and sisters for parental affection and by severe emotional shock of any kind. Children of foreign-born parents face peculiar uncertainties due to a conflict of cultures. They find it hard to harmonize the Old World standards of their parents with the expectations of their playmates. Children growing up in an occupied country face the same sort of culture conflict. Warfare and postwar disorganization multiply the opportunities for insecurity. Children are moved often, living in unsettled conditions, lacking a chance to build up a stable predictable environment. Evacuation separates children from their parents, often, in the experience of English psychologists, with catastrophic effects. Economic depressions produce similar effects. Children who grow up in a minority group are a special case in respect to insecurity. The minor-

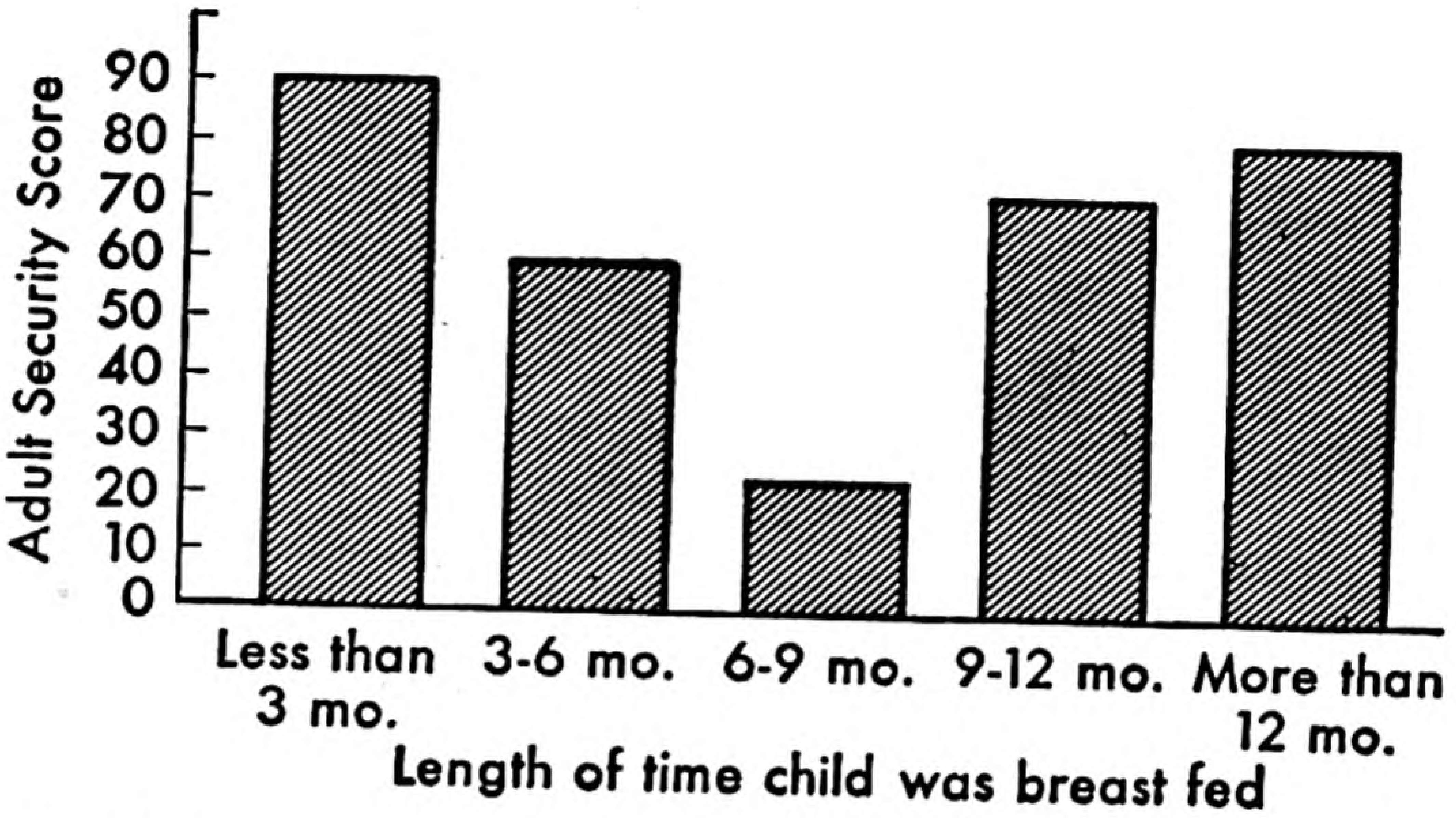

Fig. 121. Breast feeding and feelings of security. College students answered a questionnaire that asked about feelings of security and insecurity and gave a total security score for each student. These students were also asked how long they were breast-fed when they were infants. The chart shows average security score for those students who were breast-fed less than 3 months, for those who were breast-fed from 3 to 6 months, and so on. (*Data from Maslow.*[20])

ity-group family is often a tightly knit family, bound closely by hostility from without. Then, from this affectionate family circle the child may be thrust into a school or neighborhood that persecutes him, with the unsubtle cruelty of youth, thus increasing greatly the difficulty of his task of finding a stable position in the outside world. Furthermore, any youngster is capable of absorbing sympathetically the insecurities of the adults in the family, the sources of which are many and varied. (The various modes of reaction to these insecurities will be described in the next section.)

"Dominance," "social initiative," "self-esteem," and "self-confidence" are terms used for a personality trait that ramifies throughout the whole structure of personality, in man or animals, and which has, therefore, been studied quite intensively by psychologists. Constitutional factors enter into its origin in a complex way, because it is easier for a husky man, or a husky ape, to dominate his colleagues, but it is more important for a weakling to do so. Direct training leading to mastery of the relevant skills may enter into the origin of dominance also, as in the nursery-school experiments described earlier, but this does not occur in the ordinary or family-variety case. Young men and women who are above average in dominance come more often from families of above-average income and social prestige than from families below average in these enviable qualities. Self-confident adults usually give a history of being allowed some freedom and responsibility when young. Dominant women often report identification with the father, rather than the mother, who may be remembered as a "weak" character. Overprotection by either parent interferes with the normal development of initiative and self-esteem.[21] In adult life, improvements in social status, as when a man is promoted to greater responsibilities, or gets his picture in a liquor advertisement, are usually accompanied by increased initiative and self-esteem.

Dominance and sex are tied to each other in a complex reciprocal relationship. The male of the species is more dominant on the average than the female, a difference that is partly a constitutional difference based on size and strength, found also in the apes, and partly a cultural difference that can be reversed—in fact among the Tchambuli, a primitive tribe in New Guinea, the men are the clinging vines and the women have the authority. Furthermore, masculine women are more dominant than feminine women. But, on the other hand, dominant

women are more interested in sex than nondominant women, and are much less likely to be virgin at age twenty-five.[22]

Next door to this matter of initiative or self-esteem is the height or status toward which a person yearns, his level of aspiration. The origin of this trait was discussed briefly in Chap. 3.

A series of experiments on political climate and character development has recently been carried out by a group of psychologists at the University of Iowa. The topic is the effects of democratic and autocratic atmospheres on personality. Lewin, Lippitt, and White [23] trained boys'-club leaders to adopt democratic techniques at one time and autocratic techniques at another. (See Chap. 9 regarding these two techniques of leadership.) "Democratic" in this case means that the leader started discussion going and helped in the group organization when necessary, but left the determination of policies and programs up to the boys' collective judgment. "Autocratic" means that the leader decided what was best for the boys and told them to do it. The boys held their meetings for a few months in one atmosphere, then a few months in the other, with the experimenters controlling the conditions the way a bacteriologist controls the culture of his specimens growing in a glass jar. What happened?

The boys were not openly discontented under the autocratic leaders. They impressed observers, who had seen the liveliness of the same boys in a democratic climate, as dull, submissive, and apathetic, but not particularly unhappy. They were not overtly quarrelsome except —and here is the weak spot in the autocrat's armor—for wild outbursts of aggression when the leader left the room. Their reaction boiled over, also, in the form of dirty digs, hostile jokes, and similar indirect expressions of aggression, which were 30 times as frequent under autocratic as under democratic conditions, and most of which were directed toward two convenient scapegoats in the group, *none toward the autocrat*. The transition from autocratic to democratic leadership was marked by explosions of aggressiveness for a short time before the boys settled down into the characteristic good-humored aggressiveness, medium in intensity, of active boys. Out of 20 boys, 19 liked the democratic leaders better; the twentieth was the son of a Regular Army officer.

These experiments on attitude toward authority apply as much to social relations and government as to personality. The critical prin-

ciple is that this attitude, learned in the family and other face-to-face groups, transfers to larger secondary groups, to relations between teacher and pupils, between sergeant and private, and between foremen and apprentices. Those on the democratic side are accustomed to include others in their decisions, and to be included. They hate to be bullied and get no thrill out of pushing others around. They see other human beings *as* human beings, each one with a right to his say and a potential contributor to the group. The authoritarians characteristically seek out the power relations in the social organization, finding security in knowing whom to be bossed by and whom to boss. They see other people as positions in the chain of command, and in time of crisis are likely to want a "strong man" at the top to make the trains run on time.

When anyone thinks of authoritarianism today, he thinks of the Hitler *Jugend,* Hitler's heiling, goose-stepping yes-boys. Are the attitudes toward authority of these young Germans (remember that their fathers used to be described as *gemütlich*) really different from those of young Americans? To compare the attitudes of youngsters in different hemispheres speaking different languages is not an easy task, but a beginning has been made. Dr. Donald McGranahan [24] of Harvard University, on duty in occupied Germany in 1945 with the Information Control Division, polled a sample of German youth between fourteen and eighteen, both Nazi and anti-Nazi, regarding attitude toward authority and compared their answers with a similar group of American youth. When he asked: "Do you think the German soldier who refused, during the war, to obey an order to shoot an innocent prisoner was justified?" 50 per cent of the German youth said yes. To the same question about an American soldier, 84 per cent of the American boys said yes. The second question was: "Should people who unjustly criticize the government of a country be thrown into jail?" To this question 21 per cent of the American sample said yes, as compared with 36 per cent of the German sample. When the German sample is broken down, the percentage of yes replies from Nazis is 46, from anti-Nazis, 24. Another interesting question was worded: "In your opinion should newspapers write (*a*) what they wish, or (*b*) only what is for the good of the people?" In reply to this 81 per cent of the Americans voted for freedom of the press, 64 per cent of the anti-Nazis, and 35 per cent of the Nazis.

As McGranahan says, "the type of man a youth chooses to admire provides a clue to his values," so he asked them all the simple but revealing question: "Who is the greatest man in world history?" All the names in the first 10 listed by the German youth are symbols of great political or military power, leaders of states or armies or both, including Roosevelt, Bismarck, and Frederick the Great. But the Americans included among their first 10 four names of men who achieved greatness for other reasons: Christ, Columbus, Edison, and Franklin. And the German youth, in their subservience to the occupying authority, actually rated Eisenhower and Truman higher than the Americans did.

These two "experiments," the small-scale experiment in the boys' clubs, and the nationwide "experiment" of National Socialism, show where attitudes toward authority come from. Also important are family relationships, the techniques used by the parents in getting their own way, and techniques used by schoolteachers. All of these in turn are affected by religious values, ideologies, traditions, and philosophies.

There is a specious brittle advantage to authoritarian training, which led several commentators during the years just before the last war to contrast the softness of American youth and their disrespect for authority with the unquestioning obedience of some European youth. But there is some evidence from these two investigations and others that the democratic sort of leadership, the ideal of which is to begin with individual motivations and find a common purpose in the group as a guide to action, is the more effective in releasing the potentialities of both the individuals and the group.

***Reactive traits.*** What makes the psychology of personality complicated is that people are complicated. One man's dominant self-confident style of behavior arises from his impressive voice and physique plus superb mental capacity. The same trait in another man or woman may have been acquired secondhand as a reflection of the superior financial and cultural advantages of the parents. Still another person may be similarly dominant in a reactive way, compensating for inferiority of appearance or background. Building on the foundation established by the constitution and family training, the reaction tendencies round out the story of personality formation. Reactions to conflict have a special significance for the psychology of personality. In this case the folklore and the radio poets are correct: It is what a person

does under conflict, when the going is tough, that reveals what manner of man he is.

Many things can happen when a person is frustrated in his pursuit of a goal, and almost everyone has followed all courses of action at some time or other. But most adults, after their personalities have consolidated, meet their reverses in their own characteristic ways. Four of the more common reactions to frustration are outlined by the following incident.

You are walking rapidly down Elm Street in your best clothes to meet an important four o'clock appointment. A man whom you know slightly is walking toward you with a Boston terrier on a leash. The dog looks familiar. It may be the one you threw a stick at yesterday for chewing on one of your books. As you hasten past with a quick "hello," the dog jumps on you, making a small rip in your sleeve and scratching your arm. What are you likely to do?

1. Say very little. Arrange to talk to the man later; then get back on your course. Don't commit yourself.
2. Pass the incident off as lightly as possible. Keep out of trouble. Rest until the excitement goes away.
3. Remind yourself that it is half your fault. You probably started it by throwing the stick at the dog.
4. Insist on your rights. Force the dog's owner to admit responsibility for the dog's actions.

The first course of action would hardly be called a *re*action. It indicates persistence of activity undeterred by any emotion arising out of the frustration. It is typical of people with good self-control. Feeling secure and poised in their relations with their fellow men, they are able to tolerate such annoyances without deviating from their original purpose. In other words, the incident is handled as an intellectual problem rather than an emotional flare-up.

The tendency to minimize the whole affair, to give in and accept what the fates offer, as illustrated in the second alternative, is characteristic of people who lack the reserves of energy necessary for more determined action. Such a willingness to retreat often has a constitutional basis. A child with a weak heart or other generalized handicap is likely to develop a habit of avoiding excitement whenever possible, getting what fun he can in calmer ways. The infirmities of old age

incline the personality in the same direction. The sedate detour becomes more enjoyable than the frontal attack.

If a child, or adult, *is told* that he has to be careful, and believes it, he may develop the same habit of retreating. Physical weakness and parental overprotection can produce the same habitual submissiveness to the will of the gods. It is not uncommon in medical practice that the limitations enforced by physical disease are so satisfying that they are retained after recovery, as in the case of Hans Castorp, "life's delicate child" of *The Magic Mountain.* Some psychoneurotics, particularly neurasthenics, characteristically avoid exciting situations because all their effort is exhausted in holding their permanent conflicts under control.

A comparable lack of initiative has been observed in young adults who finished school and went job hunting during depression days. A habit of despondency is to be expected after 6 months or a year of rebuffs unmitigated by the thrill of success. It is easy, on this basis, to understand what personality research during the thirties disclosed, that prolonged unemployment has more devastating effects on the young than the old. It is easy also to understand the lack of initiative of some Negroes, in view of their hopeless frustration in search for a decent job and a decent share of the goods and prestige of this world.

The third ending of the dog incident is intended to illustrate the reaction of a person who habitually turns his emotions inward upon himself. Behind this reaction, if it is typical of an individual, showing up in many situations, one may expect to find a guilt feeling. These people have committed a sin—more often have merely thought of doing so—and they atone for it by blaming themselves indiscriminately, "turning the other cheek," whenever the opportunity arises. Some kinds of religious training, especially those with an Oriental emphasis on self-torture, reinforce this reaction tendency. The mature personality has integrated his hostile asocial impulses and the repressing prohibitions of society into a balanced ego organization—probably through identification with his parents and acceptance of his status as a civilized citizen. But in these self-punishing personalities the ego is weak, and they can hold down their guilty anxieties only by constantly finding fault with themselves. Instead of admitting the real guilt, however, they punish themselves for trivial or fancied transgressions. Chronic

alcoholics and factory workers with high accident records often show this kind of character structure.

A milder, marked-down variant of this inward kind of reaction is the self-improvement type. When this tendency is pronounced, it produces the chronic self-examiner, with his finger constantly on his moral pulse. He buys books, goes to lectures on character development, asks his friends to be frank about his weaknesses, even comes to psychologists for tests that will indicate the "flaws in my character." The origin of this reaction lies in the same feeling of guilt and in the lack of insight that permits by-passing the real "flaws" in favor of trivial and more fashionable defects. The chronic self-examiner does not "improve" his personality because he really does not want to. Only when his annoyance with himself becomes intense enough to force a conscious airing of the basic difficulties—and for this professional help is usually necessary—will there be any genuine change in the personality structure.

The fourth and most popular reaction to frustration, in extroverted America at least, is to "do something about it," preferably in an outgoing aggressive way. Commonly the reaction is related in some way to the frustrated activity, as when a person who has been annoyed feels that he in turn must annoy the annoyer. Belligerence at school may be a reaction to necessary submissiveness at home. Neatness, though it may be a residue of family or job training, may also come about as a reaction against family sloppiness that frustrated the adolescent desire for social acceptability. Or it may be a foresighted protection against anxieties and guilt feelings. Similarly cheerfulness, as everyone knows, may be a direct result of a basic satisfaction with life or a forced reaction that covers up discontent. From the mental-hygiene point of view, this direct active type of reaction to frustration is healthier than either the evasive or the inward type.

*Reactions to inferiority.* Since the drive to get ahead, to be somebody, often called the "prestige" or "power drive," is so strong in our culture and yet so often frustrated, novelists, biographers, psychiatrists, and psychologists have spent a good share of their time describing the effects of such frustration on personality. Reactions to inferiorities, real or imaginary, which bar the way up the ladder of success, go a long way toward establishing the basic style of the individual's

motivation, the posture or stance he assumes as he battles his way through life. Such reactions form a special case, which deserves special comment.

Nearly everyone is familiar with the pangs of inferiority. College students have as little to feel inferiority about as any other large group of the same age, but when college men were quizzed about physical, intellectual, and social inferiorities, over half stated that they had been troubled at some time or other about all three. Only 10 per cent reported no inferiority feelings at all. College women reported inferiority feelings even more often than college men, and their feeling of intellectual inferiority actually increased during their college days.[25]

One may react to feelings of inferiority in many ways, by rationalization, compensation, evasion, logical acceptance, and so on. Any style of reaction may in time become habitual and therefore take on the status of a consistent personality trait. One of the most common results is a compensatory reaction, habitually assuming a dominant attitude and style of life to cover up an unacknowledged inferiority. This is the well-known *inferiority complex.* Dominant, or domineering, behavior arising in compensation for inferiority can be differentiated from the more natural or direct dominance in the following way, according to Maslow.[26]

> In the first place, it is apt to be strained and unnatural. It is often more aggressive and louder than seems to be appropriate to the situation. It is apt to be somewhat vulgar, and may sometimes also give the observer the impression of expressing defiance rather than calm assurance. Such people are apt to be more "flip" than the average, to be "wise-crackers," to be ultra-sophisticated in a manner that indicates an eager desire to impress others with this quality. In several of my cases, feelings of conflict and ambivalence toward sex went with very free, even loose, talk about sex.
>
> It is interesting to observe the remarkable change in the behavior of these subjects when the hard, bright exterior has been breached by the probings of the psychologist in the interview, and the subject has confessed to feelings of inferiority, uncertainty and weakness. The burdensome cloak of defense is cast aside with a (literal) sigh of relief. The hitherto loud defiant voice becomes low and hesitant, blushes are frequent, some embarrassment and shame is evident at the beginning. There is little of the raucous, forced laughter that has characterized the subject hitherto: the blocking, the sparring, the deliberate misunderstanding of the interviewer's questions, the con-

venient forgetting, the flip, superior, sometimes disdainful attitude, all of these disappear, to be replaced by a somewhat muted sincerity, honesty and straightforwardness.

Just which direction the emotional efforts set going by frustration may take depends, like every other human activity, on several cooperating forces. Examples for emulation are offered by older men and women. But, on the other hand, children may reject their parents and all that they stand for. In this case, boys are likely to adopt the attitudes of some outside models, like the boys in the gang. When girls reject identification with their mothers, they tend to identify with their fathers, protesting against weak feminine values and activities. The traditions of the culture, the ideologies, religions, and philosophies reinforce one kind of reaction more than another. The movies and the radio emphasize the loud-talking, direct-action, uncritical reactions to frustration. Some educational agencies encourage an immediate bounce back from obstructions, while others promote an analytical trouble-shooting approach. The frustrated individual, if he has not become too rigid as a result of his emotion, will try one reaction, then another. If he forms a habit of preferring one reaction over the others, as people usually do when they settle into life's congenial grooves, it will be the one which through trial and error seems to carry him in the direction of greatest personal satisfaction and relief from his anxieties.

Anyone who has penetrated this far into the psychology of personality ought now to put the book under his pillow and go out to see these principles in operation as they have formed the personalities of specific human beings. In people he knows thoroughly, he may now be able to identify the twistings and turnings of reaction to conflict, the residues of family, recreational, and job training, and, underlying all these, the widespread influence of the given biological constitution.

But the story is still too simple. The formative influences on personality, whether they are partitioned into three parts or seven, do not operate independently of each other. It is not just a sex drive that is frustrated, but an active human being with many other goals beside the one he is seeking at the moment when he comes to the observer's notice. The structure of personality can only be understood when it is viewed as an intricate equilibrium of stresses, not a static equilibrium

like a bridge or a spider's web, but a dynamic system, more like the wings of a bird or the shape of a tree, which takes form by balancing all the straining forces from within against all the resistances from without. When new experiences, tornadoes or zephyrs, sunshine or rain, unbalance the configuration of forces, it is the whole system which responds and readjusts, maintaining its integrity by realigning the structure as much as necessary, with minimal disturbance of the basic pattern.

Usually personality changes are gradual, but at puberty, at the menopause, and in time of crisis or severe illness, the change may be rather sudden. The psychological factors that produce reorganizations of the personality are such as unemployment, sudden success, or loss of emotional support, as when a student loses his mother on whom he has been depending for constant reassurance as to his ability, or when a woman loses control of the daughter who was buttressing her failing ego. In all these cases, the normal elastic personality readjusts and encompasses the disturbance, like a tree surrounding and healing over a wound, but the center of the equilibrium is shifted a little by the disturbance. Gradual personality changes are much more frequent than sudden changes, but if the equilibrium was an unstable one, balanced on a razor's edge, one last straw may tip the balance and produce what seems to superficial observation a striking conversion. The period of personality disorganization following severe shock, before the psychological forces are balanced into a new and reasonably satisfying organization, is a matter of common observation.

For these reasons the psychology of personality *is* complicated, and always will be. Anyone who is looking for simple explanations is advised to study a simpler science, like nuclear physics or paleozoology. If there is one unifying principle, to which others are subordinate, it is the self concept, one's idea of his role in society, his ego-ideal. This central value is constructed, in part deliberately, in part unconsciously, out of awareness of weaknesses and strengths, emotional identifications with idealized and idolized characters of fact or fiction, and membership in social and occupational groups. When someone fancies himself or herself an anarchist, a Bohemian, a classroom jester, a dutiful wife, a savior, or a zany, with or without objective evidence, it makes a tremendous difference for all aspects of his personality. All but the

most trivial experiences are evaluated, and rejected or integrated into the personality, according to their agreement with this fundamental picture of the self.

## SUMMARY

A personality trait is a distinctive aspect of a person's behavior, a consistent characteristic of his style of life, which differentiates him from others. Degree of consistency is usually measured by the correlation coefficient. Broad classes of traits named for the cause of the consistency are constitutional traits, habit traits, and ego traits.

Common traits are those which everyone exhibits in some degree. People can be rated or tested in respect to each and their scores assembled for easy inspection on a psychograph. Modern statistical research is working out systems of traits for purposes of economical yet thorough description. Individual traits may be characteristic of only one person and for this reason are hard to handle quantitatively.

Methods of personality investigation may be classified under objective observation (including laboratory tests), ratings by other people, self-description (including verbal tests), and depth methods. Each of these has its own advantages and disadvantages and needs to be checked by the others.

Because human beings grow slowly and because personality description is not very precise, the origins of personality traits are hard to discover. No doubt some traits have a constitutional origin, arising in the chemistry of the blood, the endocrine glands, and the nervous tissue, of which general intelligence has the most widespread effects.

Much of personality comes also from direct training by parents and other educational agencies. A child absorbs an even larger fraction incidentally and unconsciously from his environment, and his personality in later life will reflect the opportunity for initiative, the security—or lack of these—and the social atmosphere of his early years.

Some individual traits are formed as reactions against something, against parental domination, against feelings of inferiority, against loneliness, and the like.

The development of personality is usually gradual, all these formative stresses and strains being balanced against each other. Occasionally, as in religious or political conversion, the balance may tip suddenly and dramatically.

## TECHNICAL TERMS FOR SPECIAL STUDY

character sketch
personality trait
constitutional trait
habit trait
ego trait
common trait
individual trait
schizothymia
emotional maturity
dominance
surgency
sensitive anxious emotionality
the cultured mind
character integration
obsessional inflexibility
objective observation
behavior records
ratings
forced-choice method
halo effect
self-description
depth methods
Rorschach test
projective methods
interview method
hyperthyroid
hypothyroid
castration
hermaphrodite
direct training
incidental acquisitions
security feelings
reactive traits
inferiority complex

## NOTES ON TERMINOLOGY

*personality* and *character:* the two terms are often used as equivalent. When a distinction is made, the first is a general, inclusive term, whereas the second refers to the moral or ethical aspects of conduct.

*temperament:* physiological aspects of personality, such as emotional reactivity, glandular functioning, and susceptibility to fatigue.

*personality test:* a term used both for objective observations of behavior in a standard situation controlled by the experimenter and for questionnaires that ask for reports of one's habitual conduct or feelings. The latter are objective if the reports are taken, not as self-description, but as behavior subject to further analysis and validation.

# 12

# ABNORMAL PERSONALITIES

The story of psychology is a human interest story and, like all human interest stories, becomes more entertaining when it becomes a little inhuman. Anecdotes, newspaper stories, even full-length novels and biographies increase their popularity when spiced with homosexuality, schizophrenia, lipstick murders, and other mysterious activities, which seem to lie outside the normal range of human behavior. But the scientist's interest in these queer activities is altogether different. Instead of being entranced by weird cases or moved to write a poem in praise of the mysteries of human nature, the scientist is always disturbed by irregularity and lawlessness. The ideal of science is to get all the facts, including the strange ones, straightened out and arranged so that they fit into a self-consistent lawful pattern, without remainder. Economists are eager to understand crises as well as routine business activities. Geneticists cannot overlook the two-headed calf, for if the principles of genetics do not account for freaks along with ordinary specimens, they must be revised. In the same way psychologists and psychiatrists are striving to build up a set of psychological principles that will encompass the bizarre carryings-on of the hebephrenic and the uncomfortable phobias of the neurotic as well as the less sensational behavior of their more conventional neighbors.

## *PSYCHOSOMATIC RELATIONS*

*Psychosomatic relations* are the influences of psychological factors on bodily changes and the reverse. For many years the psychoanalysts have been writing about "organ neuroses," meaning cases in which the patient's difficulties were manifested, not in disorders of conduct, like a compulsion to break things, but in physical symptoms, like ulcers or a rash on the wrist. Recently this area of science has been taken

over by psychosomatic medicine, an offspring of psychoanalysis and physiological psychology, whose lusty growth is increasing the social acceptability of both his parents.

Psychosomatic medicine is engaged in tracing, with the penetrating techniques of psychoanalysis, electrophysiology, biochemistry, and the conditioned reflex, the subtle relationships between psychological and bodily processes. Some researchers have attempted, for example, to show that the content of women's dreams is related to the menstrual cycle, maternal dreams appearing preponderantly at one time, sexual dreams at another phase, and so on.[1] Even more important is the tie-up between emotion and bodily symptoms.

Some of the principles governing the bodily effects of emotional tension have already been discussed in Chap. 2. We may recall that emotion affects the autonomic nervous system, pouring adrenalin into the blood, raising muscular tension, raising blood pressure, inhibiting stomach activity, increasing the blood supply to some parts of the body, and decreasing the supply to other parts. Adrenalin in the blood stream has widespread effects. In fact adrenalin is a standard drug, used for nose drops, for coagulating the blood, for preventing shock by raising blood pressure, and for many other surgical and medical purposes. Usually these effects are transient, developing quickly in an emergency situation, and disappearing soon after the crisis has passed. But when the individual is physically incapable of recovering at the normal rate, or when the emotional stimulus persists, these nervous and chemical disturbances become chronic. And that is where the trouble comes in. Stomach activity cannot be inhibited forever, for the gastric juices continue to flow and to irritate the walls of the stomach and intestine and may even cause gastric ulcers. Prolonged high blood pressure is a strain on the heart. The chemical products of emotion, circulating through the blood stream, may raise the sensitivity of the skin and mucous membranes, increasing the likelihood of allergies and asthmatic attacks. To those who understand the anatomy and physiology of the autonomic nervous system, it is no wonder that the effects of emotion can flood the body so thoroughly. That the results are not more serious than they are is a tribute to the resiliency of most healthy organisms. Our civilization being as exciting as it is, most healthy bodies can and do take a lot of punishment, especially when they are young and flexible.

The next question is why one troubled person will develop ulcers, another constipation, yet another will have asthma, while most people handle their problems fairly well and manage to go about their business, symptom-free. The answer in large part lies in the constitution of the individual. Thin people, for example, are more likely to have ulcers than fat people. Hereditary predispositions render one kind of body tissue more susceptible to the effects of chemical irritation than another, just as the germs of syphilis will damage one man's brain but another man's heart. And some people are tough enough to take large amounts of emotion without any noticeable injury.

The other part of the answer lies in the learning process. Examples were cited in the chapter on learning to illustrate how a person may group two ideas together, like "chair" and "table," so that when he thinks of one he thinks also of the other, and he responds to the one as he would to the other. If a word or a melody or a smell symbolizes danger, he may react to the symbol as to the real thing. If a person's eating habits have been built up in such a way that eating is primarily a social activity that symbolizes being cared for and protected, he may, when he feels neglected, compensate by eating huge quantities of food. A certain amount of obesity, in nonglandular cases, probably comes about in this way.[2] The child who went through emotional conflict in connection with toilet training and thus sees elimination as doing a favor for his parents, may, if he develops antagonistic trends in adult life, react by chronic constipation.

This whole field of psychosomatic relations is new and the number of adequately investigated cases is still small. Conclusions are bedeviled by the old hen-and-egg problem. When high blood pressure is associated with hostility, should one conclude that suppressed rage produced the high blood pressure, or the reverse? Scientifically this cause-effect question is the whole thing; therapeutically, it does not much matter which came first. To the practicing physician, the important question is whether to use psychological or medical treatment, or both. And that is a question to be decided for each individual case by examination of the symptoms and analysis of the total personality.

Just because cases that appear in clinical practice do not answer this age-old question of cause and effect, psychologists have turned to the lower animals, on which they can perform experiments that demonstrate casual relations more directly. They have actually suc-

ceeded in making nervous wrecks out of goats, pigs, dogs, and sheep by putting them into emotional conflicts, forcing them to do something when they know not what to do, or serving them electric shocks with their meals. Then they give them good nursing care and watch them carefully to see how the symptoms develop. Like human beings, some animals succumb and some do not. The susceptible ones show such bodily symptoms as high pulse rate, abnormal breathing, frequent urination, stomach acidity, and disturbed sexual behavior. Most cases recover quickly, especially when the provocation is mild, but severe mental turmoil has changed some previously healthy animals into invalids with chronic psychosomatic disorders of heart and nervous system.[3] These martyrs to the cause of science recover only after they are sent away to the country for a long rest and change of scene

## THE PSYCHONEUROSES

A *psychoneurosis* is an illness characterized by anxieties, compulsions, fears, and so on, which make a person unhappy but usually do not change his whole personality or prevent him from working. These people realize that they are sick and seek help voluntarily. Although the statistics on psychoneuroses are not dependable, the experts estimate that this kind of difficulty is more prevalent than any of the other ills that man is heir to, except the common cold. Some psychiatrists will claim that half the patients seen by the family doctor have psychoneurotic complications. For the general population the round figure of 10 per cent is commonly given as an indication of the number who have had or will have a psychoneurosis sometime during their lives. When the going is extremely tough, as on Guadalcanal in October, 1942, the percentage is higher. Here is a brief report of a severe case, described by Dr. Lidz, an Army medical officer.[4]

> A twenty-year-old marine was admitted to the hospital approximately a week after evacuation from Guadalcanal. He appeared depressed and stunned; started sharply at any sudden sound; and could not halt his preoccupations with recent events. He ate poorly and his sleep was broken by nightmares. With considerable emotion, he told of how his gun emplacement had been struck by a bomb. He had seen the remainder of the crew killed as he was tossed through the air by the concussion. He remembered nothing that happened for several hours thereafter, but did not think that

he had been unconscious as he had been told that he had "gone wild" almost immediately. In the hospital he could not control his sobbing during air raids and remained extremely jittery. He admitted that he had been finding it difficult to control himself for several weeks prior to the bomb-hit. He had choked on his food, vomited occasionally, and rarely dared to sleep. He had remained at his post hiding his apprehension from his friends. The reason for the panic reaction sounded adequate, especially when the numerous lesser traumata and the many resentments held in common with others on Guadalcanal were taken into account.

The patient improved. He kept well occupied during the day, participated in the grousing sessions on the ward, and his old buoyancy began to return. He was considered less ill than most and received little individual attention. Then he became ill with atypical pneumonia and was transferred to an isolation tent where inactivity was forced upon him. While convalescing he suddenly became rigid and cataleptic. With suggestion, he took oral sedation, sobbed uncontrollably and finally began to talk. The story of the bomb-hit was retold. He had been sitting in the emplacement with his lifelong "Buddy" with whom he had gone to school, college and into the marines. His "Buddy" had yelled "Look out." In the next moment he had seen his friend blown to bits. The episode had not been forgotten, but he had avoided mention of the friend as being too painful for discussion. Subsequent discussion revealed that they had been inseparable since early childhood. The patient had regarded his friend's home as his own, and the parents even more affectionately than his own, even though his family life had been satisfactory as far as could be learned. They had patterned their lives together for many years. Now all plans had disintegrated and the patient was facing the future alone for the first time. Discussions centered about problems of mourning and the reorganization of his life without his friend. Sharing his troubles, the patient began to improve, but he remained anxious and after a week another spell of rigidity occurred.

It was learned that he had been contemplating the necessity of writing letters to his friend's widow and mother. He was unable to write and became overwhelmed at the thought of returning home and facing them. They had both taken out the same girl, but the patient had stepped aside when he realized that his "Buddy" wished to marry her, and went out with her sister instead. His older brother had married this sister shortly before the patient joined the marines. There was further improvement. The letters were written, but he remained restless and anxious. During subsequent talks an opportunity was presented to discuss his feelings towards his friend's widow. With much embarrassment and considerable guilt, he admitted to having had fleeting fantasies of marrying her. He was encouraged

to express his admiration for her. Their many mutual interests and sorrows were discussed, and he learned that his feeling for her was not disgraceful. He acted as if relieved of a great burden. He was much improved when he left the hospital to recuperate in the United States. A year later a wedding invitation was received accompanied by a note telling that he was well and employed by a Federal agency that requires considerable calm and courage.

Why is this marine tagged as "psychoneurotic"? And how do psychoneurotics differ from other people? The experts do not agree on the definition or nature of this illness, but in diagnosis they all follow the same procedure of looking for the symptoms they have seen in other psychoneurotics. They look for evidence of extreme anxiety or fear, which comes on in the absence of real danger or persists long after the danger is past. This is the chief symptom in the case of the twenty-year-old marine and in fact is one of the commonest in all military psychoneuroses. They look for obsessional ideas, like the thought of suicide, that keep running through the patient's mind in spite of his efforts to cast them out, and for uncontrollable compulsive acts, like unnecessary ritualistic hand-washing. They look also for physical symptoms, like paralysis, vomiting, and anesthesia, which are related to psychological difficulties. Naturally a thorough medical examination is carried out in order to eliminate the possibility that these symptoms are caused by physical illness, such as injury or infection of the nervous system. It is not very difficult in most cases to differentiate the psychoneurotic from the insane, for the pattern of the symptoms and particularly the course of the disease present contrasting pictures.

The causes for psychoneurosis are not well understood, for the same reason that the causes of all the varieties of normal personality are not well known. There must be many causes, in the present and in the past, but no one has been able to follow the development of enough people over a long enough period of time to discover why the psychoneurotics are different from the rest. The researchers have had to take their patients as they find them and work backward, trying to reconstruct the past from which the illness sprang. The conclusions from this kind of research cannot be taken too seriously.

Certainly it is not an accident that some people develop a psychoneurosis and others do not. The majority of the marines stood up

under even the ghastly horrors of the early days of the war in the Pacific. Constitutional predispositions no doubt play a part here as elsewhere. Some nervous systems are able to bear up under a stronger attack than others. The glandular make-up of one person may recover more quickly and completely than that of another. Disorders of heart action and of the functioning of the autonomic nervous system are fairly common among neurotics. The statistics coming out of all theaters of the recent war agree that the majority of the military neuropsychiatric casualties had a history of similar upset in civilian life, though often in milder form.

This susceptibility to psychoneurosis comes partly from hereditary make-up and partly from childhood experiences. Every child as he grows up has to achieve, either by himself or by emulation of his parents, some sort of equilibrium between his drives to action and the restraining forces of society. When this equilibrium is a stable well-integrated one, it can endure considerable stress. A breakdown is more likely to occur in those people who have never really solved these problems of development and must keep working at them daily, even though unconsciously. Drives connected with sex and prestige are prevalent sources of trouble, because our culture has never made up its mind how much freedom to allow these two human impulses. Sex is stimulated one minute and inhibited the next. Adolescents are told that they have to fight to get ahead and that they should respect the golden rule. In spite of these inconsistencies, most people do manage to build some sort of balanced personality, taking their motives and emotions as they come or modifying them in the socially approved directions, taking society's taboos as they are or reinterpreting them so that they are not so restrictive—achieving somehow a structure that will stand alone, patched and wind-blown though it may be.

When the structure totters and breaks down, the history often shows that some childhood problems have never been faced and solved. The hot fires of youthful sexuality have been covered and left to smoulder. A rigid notion of morality, picked up from puritanical parents, has made it impossible for the youngster to accept his own impulses of hostility, cowardice, or self-esteem, and to live with them in the same tenement of clay.

If the precariously balanced personality does give way before a strong blast, such as loss of a job, unhappy marriage, military combat,

or severe illness, the symptoms are never the simple result of a simple frustrated drive, like the anger of a child who is deprived of his candy. To the expert eye the symptoms often appear as the reactions of a complex, highly organized individual, trying to maintain his self-respect and the integrity of his ego. Neurotic complaints are not common traits but individual traits (see page 376). Nevertheless the nature of the breakdown gives a clue, if its language is understood, to the underlying difficulty. In the case of the twenty-year-old marine on Guadalcanal, his feeling of guilt about loving his buddy's wife was confused with his buddy's death in combat. Instead of admitting the minor wrong, he became severely upset over the fancied major crime. Neurotics, in their pathetic desire for affection, take the dictates of society very seriously, in a rigid perfectionistic way. (The child of nature, if there were any such, would be a poor candidate for psychoneurosis.) Recognition of their own hostile asocial motivation frightens them, and, in fact, most of the psychoneurotic's symptoms can be understood as allaying this fear. And that is why they cling to their symptoms so tenaciously. Phobias, for example, develop around situations that have been associated with anxiety in the past or, more commonly, that the neurotic associates with anxiety by some devious logic of his own.

The symptoms of the psychoneurosis can be interpreted as ways of defending the ego against threats from one side or the other, but just what situations the patient sees as threats and just what symptoms he assumes as defenses depend on certain peculiarities of his own learning processes. Vomiting, to take one illustration, is ordinarily an involuntary activity, which occurs when the contents of the stomach are in a certain chemical condition or when the throat is stimulated in a certain definite way. But these internal physical stimuli can be associated with external stimuli, such as the sound of a voice over the telephone or the appearance of a particular room, so that the external stimuli will produce the vomiting. Adequate sexual intercourse requires the cooperation of several muscle groups, but if this activity has been associated with degradation or threat, either through unfortunate childhood experiences or through the confusions of a hit-or-miss sex education, the cooperation will not take place. It is true that human beings learn their neurotic symptoms the way they learn their multi-

plication tables, but the background of emotional tension is so strong that very little drill is necessary.

The cultural background also will slant the symptoms this way and that, for vomiting in our culture is traditionally associated with disgust, while sexual activity in women is associated with submission and in men with mastery. And learning ego defenses is like learning the multiplication table; if one learns what the others learn, he is less likely to be considered peculiar and made to feel on the defensive. The symptoms of hysteria are particularly subject to the social pressures of the environment, for hysterical people are characteristically suggestible and easily influenced by stray ideas and fashionable afflictions. When social conditions are favorable, a wave of hysteria may sweep through a community, starting a "mental epidemic" characterized by the same complaints in many of the more susceptible people. Historians have written lurid accounts of mass hysteria, like the "dancing mania," which swept through Europe in the Middle Ages, and the "arctic hysteria" of the Siberian aborigines. But the best-documented case of a mental epidemic occurred only recently in an ordinary Middle Western American community.[5]

The story of the "phantom anesthetist" begins in Mattoon, Illinois, on the first night of September, 1944, when a woman reported to the police that someone had opened her bedroom window and sprayed her with a sickish, sweet-smelling gas, which partially paralyzed her legs and made her ill. Soon other cases with similar symptoms were reported, and the police organized a full-scale effort to catch the elusive "gasser." Some of the Mattoon citizens armed themselves with shotguns and sat on their doorsteps to wait for him; some even claimed that they caught a glimpse of him and heard him pumping his spray gun. As the number of cases increased—as many as seven in one night—and the facilities of the local police seemed inadequate to the size of the task, the state police with radio-equipped squad cars were called in, and scientific crime-detection experts went to work, analyzing stray rags for gaseous chemicals and checking the records of patients recently released from state institutions. Before long the "phantom anesthetist" of Mattoon had appeared in newspapers all over the United States, and Mattoon servicemen in New Guinea and India were writing home anxiously inquiring about their wives and mothers. After 10 days of such excitement, when all victims had recovered and no substantial clues had been found, the police began to talk of "imagination," and some of the

newspapers ran columns on "mass hysteria"; the episode of the "phantom anesthetist" was over.

The symptoms reported during the height of the affair were nausea and vomiting, palpitations, paralysis of the legs, dryness of the mouth and throat, and, in one case at least, burns about the mouth. All cases recovered rapidly, hence there was little possibility for outside check on the symptoms. In four cases that were seen by physicians, the diagnosis was hysteria.

As the excitement was beginning to die down, a psychologist from the state university got on the job, analyzed police records, and interviewed the victims, trying to figure out the psychology of the incident. Two principal factors behind the affair, one social and one personal, soon became evident. The first one was the exciting social climate developed by the local newspaper through the display of such headlines as ANESTHETIC PROWLER ON LOOSE and MAD ANESTHETIST STRIKES AGAIN. Public anticipation was aroused to the point where women peered anxiously through the dark for a glimpse of the "gasser" and, as the psychology of perception would lead us to expect, interpreted stray sights and smells as signs of his presence. At the height of the excitement, the Commissioner of Police stated that he would not walk through anyone's backyard for $1,000. But not all of Mattoon's 16,000 residents were so gullible. The other factor in the appearance of the symptoms was the personalities of certain people, which made them unusually susceptible. The victims were different from their neighbors on the whole in that they were relatively low in education and in economic status. Furthermore, many reported to the psychologist that they had "always been nervous" or had been "doctoring for nerves." This strange human phenomenon, which many who were reading newspapers in 1944 will recall, demonstrates an age-old psychological principle of social psychology, namely, that all such dramatic events require both an appropriate social climate and a susceptible personality.

Most people get along with their troubles tolerably well and manage to work their way out of their own entanglements. When the noose draws so tight that they need expert advice to help them out, the therapist's first task is to find the underlying conflict. Usually an intelligent patient can talk about his troubles to a sympathetic consultant, after a confidential permissive relationship has been established. The psychologist is careful not to line himself up with any of the conflicting forces behind the patient's problems but rather to take a neutral position, encouraging the patient to understand and accept his own dangerous attitudes and impulses. Special techniques may be re-

quired, like hypnosis (see page 265), depth methods of personality examination (see page 392), or the use of drugs, like sodium pentothal, which seem to make it easier for a severely distraught person to ventilate his anxieties.

When the conflict is uncovered and aired, recovery may follow. If not, a period of retraining is necessary. Somehow the patient must redirect, or reinterpret his conflicting motives so that they are no longer at cross-purposes, and must strengthen his ego so that it can stand more short-time strain for the sake of long-time goals.

The statistics on recovery agree that young people are easier to treat than old, that recent illnesses recover more quickly than ancient ones of long standing, and that psychoneuroses following precipitating causes of great provocation, like prolonged military combat, clear up rather rapidly and completely. Statistical comparisons between different kinds of therapies are not trustworthy and do not permit the statement that one kind is better than another or that any is better than none.

## THE PSYCHOSES

"Insanity" is an old-fashioned legal term, which modern psychiatrists prefer not to use. Testifying as to the sanity of the accused before a court of law, where the ancient words are hallowed, psychiatrists must hew to the wording of the state law and talk about "being able to testify in his own defense" or "understanding the consequences of his acts." Technically, psychiatrists prefer to talk about psychoses, a small number of mental diseases, some of which produce conduct that gets into the law courts and some of which do not. All psychoses, however, produce radical changes in the personality of the patient, and most of these patients require hospital care.

To most people the magnitude of the problem of mental disease will come as a shock. (Because psychotic patients, in contrast to psychoneurotics, are usually cared for in mental hospitals at some stage of the disease, the statistics are reasonably adequate.) Some of the figures collected by Landis and Page[6] of the New York State Psychiatric Institute are startling. Of the million or so hospital beds in the United States, about half are warmed by patients with some nervous or mental disease. The capital tied up in the care of these

patients at last accounting was over $500,000,000 (prewar money), and the annual expenditure was over $100,000,000. Landis and Page estimate that one out of every two hundred adults in the general population is likely to be a patient in a mental hospital during an ordinary peacetime year like 1935. Adding in those who are cared for outside the state hospitals, they get a figure between 1 and 2 per cent for the proportion of the adult population that is mentally ill during one calendar year. Incidentally, the proportions in England, Wales, Finland, Norway, and Sweden are just about the same as in the United States.

*Chances in* 100 *of Becoming a Patient in a Mental Hospital*

| *Age* | *Men* | *Women* |
|---|---|---|
| 0 | 5.5 | 4.9 |
| 10 | 6.1 | 5.4 |
| 20 | 5.9 | 5.3 |
| 30 | 5.3 | 4.8 |
| 40 | 4.6 | 4.2 |
| 50 | 3.9 | 3.5 |
| 60 | 3.4 | 3.1 |
| 70 | 3.1 | 2.8 |

The table above shows a person's chances at various ages of being taken to a mental institution sometime during his or her lifetime. The figures are for New York State, which, together with Massachusetts, has more adequate hospital facilities than the others. Residents of other states are just as likely to have a psychosis but slightly less likely to spend it in a state hospital. A newborn babe has about 5 chances out of 100 of someday being a mental patient. If he lives until fifty and is not yet hospitalized, his chances are better. The longer he lives on the outside, the less likely he is to get inside.[7]

Psychoses are produced by drugs, brain injuries, brain infections, hardening of the arteries of the brain and other manifestations of old age, but the most interesting psychologically are the two, of unknown cause, which together account for over half the resident population

of mental hospitals in the United States, namely, manic-depressive psychosis and schizophrenia.

*Manic-depressive psychosis*, as its hyphenated name indicates, includes both mania and depression. When a manic attack takes hold, the patient becomes excited and elated, talks a lot, and is likely to consider himself witty. He can usually carry on a conversation, but is easily distracted; in fact one symptom goes by the colorful name, "flight of ideas." Cases of all degrees of severity have been seen. The mild ones get along quite well in ordinary life. They are rather trying to their husbands and wives, but some succeed in channeling their restlessness into productive work. Acute cases require constant care because they throw all restraint to the winds and follow the lead of each shifting passion. As their spirits soar, their judgment becomes poorer. They usually lose weight because they do not have time to eat or sleep. They may become irritable and pugnacious.

A mental depression is in many ways opposite to an attack of mania. Activity and speech are blocked. Appetite is inhibited and constipation is common. These patients feel gloomy, blame themselves for all kinds of crimes, and many, if not guarded, will commit suicide.

Since mania and depression have the similarity of opposites, and since cases are known in which the patient had mania one year and depression the next, the two are often considered phases of the same psychosis, which is then called *manic-depressive psychosis*. About 10 out of every 100,000 people in the United States are admitted to mental hospitals every year with this affliction. It is more common in women than in men. Average age of onset is forty years. They usually recover and go home within a year.

*Schizophrenia* or *dementia praecox* is a disorder of the relatively young, for average age of onset is thirty-three, and cases as young as fifteen are occasionally seen. The most characteristic symptom is a gradual mental deterioration, accompanied by withdrawal of interest in the people and things of the real world. A good illustration of this disease is the case of a French girl, described by the psychiatrist A. J. Rosanoff.[8]

Adrienne P., corset maker, twenty-five years old at the onset of her illness. Heredity: paternal grandfather died at the age of sixty years of senile dementia; father is an alcoholic, has been committed twice; paternal aunt committed suicide. The patient began to walk and speak very late in

childhood; menstruation appeared at the age of seventeen, has been regular but painful. She showed no abnormality in intelligence or disposition. At nineteen, pleurisy. At twenty-four, scarlet fever during a sojourn in London. Since the scarlet fever her relatives noticed a change in her mental condition from the letters which she wrote home. On her return to France in October Adrienne was gloomy, irritable, apathetic. Much worried about her health, she consulted several physicians but with no appreciable result.

On October 20, a year later, acute symptoms set in in the form of disorders of perception. People are "droll," the dishes served in the restaurant are "droll," life is "droll" and "absurd." At the same time hallucinations of vision appeared: the patient saw men following her, also ghosts and stars. On October 26 she started out to go to her sister who lived in the suburbs of Paris; failing to find her she walked at random and wandered around the country for two days and two nights. She was found walking along a railroad track, her hair undone, her clothes in disorder; they arrested her and took her to the Corbeil Hospital where she remained eight days in complete mutism. On her return to her mother her mutism disappeared, but she gave no explanation of what she did, telling simply that she had seen things which frightened her: terrible men and animals. For some time she remained relatively quiet, but depressed and intractable. She refused to see a physician, though her mother begged her to do so. On the night of November 24 she suddenly became greatly excited, cried, gesticulated, and uttered incoherent remarks some of which were suggestive of hallucinations; she spoke of men following her and of saints whom she saw. She tried to throw herself out of the window.

On being brought to the clinic on November 28 she was almost completely mute. To all questions put to her she responded by outlandish gestures and grimaces bearing no reference to the questions. On being asked to write she tore the piece of paper which was offered to her.

On December 1, at the occasion of a visit from her mother, Adrienne came out of her mutism but her remarks were incoherent. "She cannot see, she can see very clearly. . . . It is Alfred, it is Martin speaking to her. . . . They are not saying anything." It was very difficult to tell whether she really had hallucinations.

Toward the evening she became totally estranged from the external world. She no longer responded to any question.

Spells of excitement and of stupor have since then followed each other without any regularity.

The excitement is purely automatic. The same movements are constantly repeated monotonously and aimlessly. For hours at a time the patient goes through peculiar and incomprehensible gestures, striking the floor alter-

nately with the right foot and with the left foot, and extending her arms and clinching her fists in a threatening manner but never striking anyone. She stands up in her bed in a dramatic attitude, draped with the blanket, and frozen, so to speak, in that position, uncomfortable as it is. In her attacks of excitement she displays considerable physical strength. On May 25 she made a steady, persistent attempt to leave her bed and get out of the dormitory; her eyes were shut, her expression apathetic, and she uttered not a word or a cry. Several nurses held her back with difficulty.

She shows marked negativism. Refusal of food is at times complete, and then the patient has to be tube-fed; at other times it is partial, the patient taking only liquid food which is poured into her mouth by means of a feeding cup and which she then swallows readily. On November 4, without any apparent reason, she ate spontaneously a piece of bread which she took from the table. For two days she thus took bread, cheese, and chocolate, but persistently refused everything else. Later she relapsed into the former state and now takes none but liquid food which has to be poured into her mouth. Her sensibility appears to be normal, but all reaction is annihilated. Painful pricking with a pin causes slight trembling, but no cry, nor any movement of defense.

The patient soils and wets her bed frequently, though not constantly, both during the periods of excitement and during those of stupor.

The general nutrition is profoundly affected; the skin is discolored, the hair is falling out, and there is considerable emaciation: from December to May her weight fell from 94 to 77 pounds.

About four years after the first symptoms were first noticed, when Adrienne was twenty-nine, she was considered completely incurable and transferred to another institution.

Although dementia praecox, or schizophrenia, is officially listed as one psychosis, many types of reaction are included under this label. *Hebephrenics* are characterized by silliness, bizarre mannerisms, hallucinations, and laughter without apparent cause. *Catatonics*, like Adrienne, present the curious phenomenon of stupor and muscular rigidity. These patients will often sit motionless for hours, shifting position only when they are not being watched. Some are impulsive, coming suddenly out of their stupor to ask who won the game or to assault an innocent bystander. In the *paranoid* form of this psychosis, the principal symptoms are suspiciousness, and delusions of persecution and grandeur. A paranoid may be dangerous because, if he feels that someone is plotting to kill him, the sensible thing to do is to get the

other fellow first. If the paranoid patient does not deteriorate—and many do not—his delusional system may be convincingly put together. These are the ones who cause trouble in the law courts.

Dementia praecox is somewhat more common than manic-depressive psychosis, about 15 cases out of every 100,000 adults being hospitalized each year. And this illness accounts for almost half of the total hospital population because so few of these patients recover. In fact only 25 to 30 per cent are discharged within a year, and many settle down to stay for life. It is somewhat more frequent among men than women.

The causes of these two mental diseases are unknown. Many attempts have been made to find a medical cause, some disorder of the brain, infected tonsils or sinuses, some quirk in the chemistry of the blood or the functioning of the endocrine glands, but the case has not been proved. Heredity has something to do with the origin of both manic-depressive psychosis and schizophrenia; at least a person's chances of having either kind of insanity are definitely greater if he has a brother or sister who is afflicted. The chances are still small, however, and it is still true that the bulk of the cases come from parents who have no psychosis at all. Age must have something to do with the cause of these abnormalities, because psychosis before fifteen is very rare and each type of psychosis attacks its victims during a characteristic portion of the life span. Schizophrenia is typical of young adults, manic-depressive psychosis of middle age, and there are other psychoses which are limited to the old-age period. The importance of age is illustrated in Fig. 122, which shows the rate of admission to state mental hospitals during a typical year.

One might suppose that the patient's life situation, his trials and tribulations, would bring on a psychosis, would "drive him crazy," as the saying goes, and this is true in the sense that the day of onset may be moved forward or backward a few weeks. But the percentage of cases of each kind and the age of onset seem to be quite uniform, according to the data assembled by Landis and Page, in all the countries that have good statistics, including the Scandinavians and the Russians, regardless of economic depression, warfare, and pestilence. The number of cases admitted to hospitals is increasing each year, because hospital facilities are being increased and because people are now living long enough to succumb to the mental illnesses associated

with old age. When corrections are made for these two factors, no increase in incidence of psychosis is evident.

There is simply no evidence for the notion that the complexities of modern civilization are increasing the insanity rate. Civilization has been blamed for so many of the ills of the day; she ought to be spared this ultimate reproach. As far as causation of mental disease goes, research results to date are discouraging. The reason for this state of affairs no doubt is the fact that the best minds of the country and the most money have been dedicated to other pursuits.

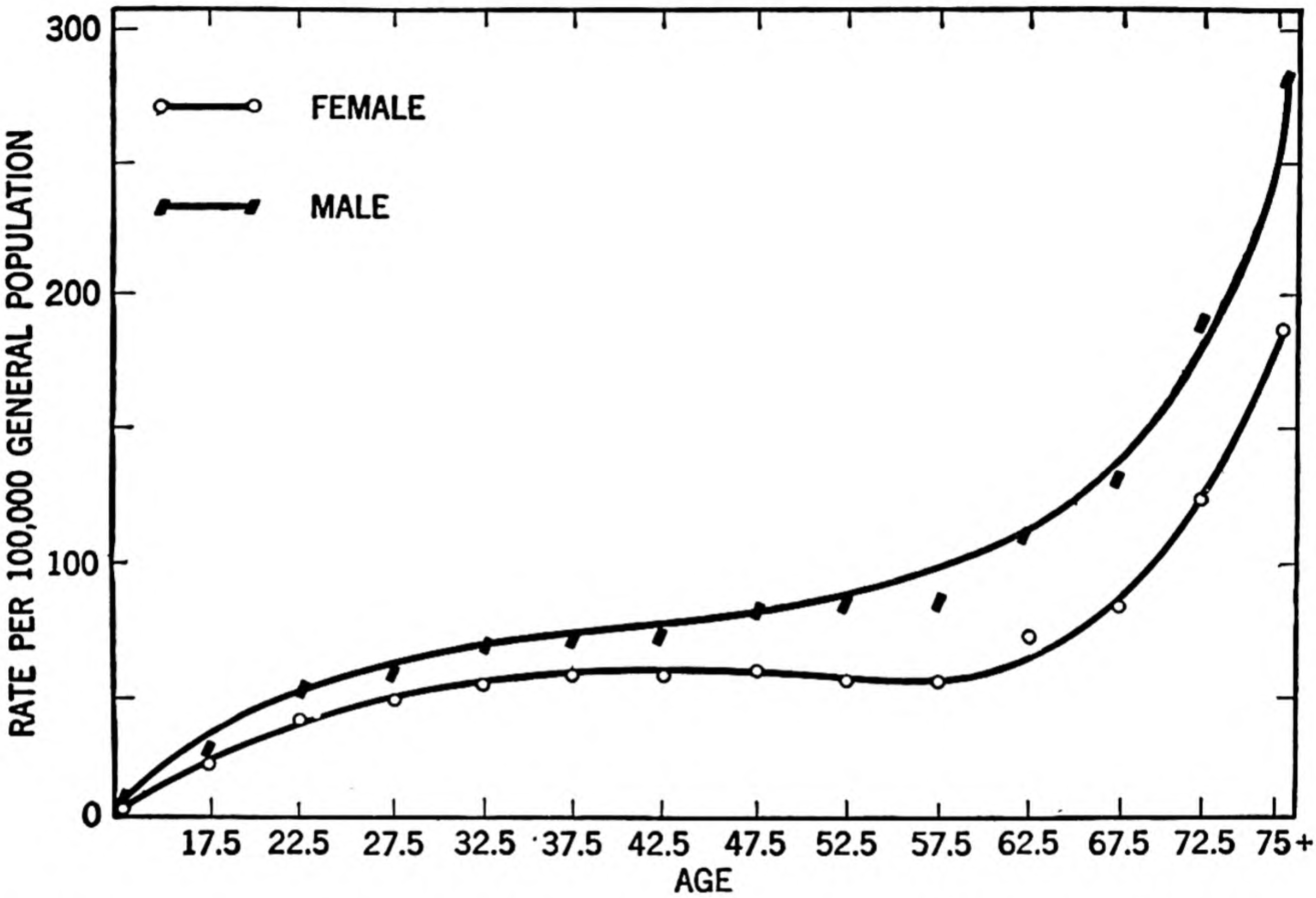

Fig. 122. Number of first admissions to state mental hospitals in the United States by age and sex, expressed as rates per 100,000 of the corresponding general population. (*From Landis and Page, Modern society and mental disease, Rinehart, 1938. By permission of the authors.*)

Knowledge of manic-depressive psychosis and schizophrenia is in the same state as knowledge of cancer. The actual cause is not known, but the course of the disease and the meaning of the symptoms in both cases have been partly worked out and catalogued. Though the revolution has been a quiet one, over a period of years psychiatrists have lost interest in the specific symptoms and now see the change in the patient's behavior as the reaction of a complex dynamic organization, *i.e.*, the personality, to the intrusion of some pathological agent

—much like an exaggeration of the reaction of a normal personality to frustration. And the nature of the personality disturbance will reflect the nature of the prepsychotic personality and constitution. Extroverted sociable people—called "cyclothymes" on page 380—of the stocky body type, are somewhat more likely, the statistics show, to develop manic-depressive psychosis, if they become psychotic. Introverted people—called "schizothymes" on page 379—of the thin body type, incline toward schizophrenia.[9] There is a tie-up also between the inheritance of schizophrenia and vulnerability to tuberculosis.[10]

Once the pathological process is under way—whatever it is that starts it—the pattern of the symptoms can usually be understood by a sympathetic observer who has mastered the principles of personality development outlined in this book. Paranoid patients, for example, often have a history of sexual difficulties, especially homosexuality, and their delusions appear reasonable as a projection of a guilty patient's attitude toward himself onto someone else, whom he therefore accuses, lest the other fellow accuse him. The requirements of good logic, which irk less intense personalities, do not bother the paranoid because, as his disease progresses, he loses interest in social communication and retreats to a world of his own where his special brand of logic is supreme. Hebephrenics and catatonics are so far withdrawn from social intercourse that they usually do not even try to rationalize their behavior. The behavior of a manic patient makes sense as a kind of one-man Mardi Gras, a prolonged spree, celebrating the removal of social constraints and self-criticism. No more kowtowing to reality. Politeness, morality, good judgment, good taste, and other inhibitions can be abandoned. "I'm crazy and I'm enjoying it! Get out of the way!" Depressive states can be interpreted as an overpowering development of the punishing forces of the personality. There is no use doing anything because everything is wrong. "I've been the cause of so much trouble. I ought to be dead." However, most periods of celebration and mourning finally come to an end. (There is a close analogy between mental depressions in the individual and the economic depressions of society. Both can be described in great detail. The course typically followed into depression and back to recovery has often been charted. But just what starts it and stops it, and what can be done to interfere with the cycle, are not at all clear.)

In the treatment of psychosis there is hardly anything that has not

been tried. In the gruesome past of not so many years ago, these patients were tortured to exorcise the demons. They have undergone surgical operations to remove infections in tonsils, teeth, and appendixes. They have been exposed to music, and to dancing girls, and they have been locked up in chambers with double the usual percentage of oxygen. They have been subjected to high temperatures and even inoculated with malaria. They have been shocked by insulin, by electricity, and by psychoanalysts. Brain operations are now being performed to disconnect the frontal lobes from the rest of the brain, with fair results for anxiety cases. In only one psychosis, general paresis, which is caused by syphilis of the brain, is the treatment specific to the disease. Raising the temperature of the body, either by giving the patient malaria or by focusing electric currents upon him for several hours, kills the germs and halts the damage to the nervous system. Results are very encouraging. In the other psychoses, of unknown origin, treatment is still largely a matter of guesswork. Manic-depressives usually recover by themselves if given good nursing care. In schizophrenia the effects of the disease are so serious that it is worth while to try almost anything. And there is always the possibility that discovery of an adequate method of treatment will lead, by a detour, to discovery of the cause.

## SUMMARY

Modern psychological science aims to understand abnormal as well as normal behavior. Psychosomatic relations between emotions and bodily changes depend in part on the functioning of the autonomic nervous system, complicated by the learning process. Psychoneurotic reactions develop when people of susceptible constitutions are entangled in particularly troublesome circumstances. The symptoms usually have some psychological significance to the troubled patient. Many, for example, can be interpreted as devices for protecting a sensitive ego.

Psychoses are more serious, involving a massive change in the personality. Some psychoses are due to medical causes, such as drugs and infections, but the causes of manic-depressive psychosis and schizophrenia, the two of most frequent occurrence, are unknown. Heredity has something to do with both. Age is important. The symptom pic-

ture can often be superficially understood even though basic causes are unknown. Treatment of a few psychoses rests on a knowledge of the disease process, as in the psychoses associated with medical diseases, but in most cases treatment is symptomatic.

## TECHNICAL TERMS FOR SPECIAL STUDY

- psychosomatic
- psychoneurosis
- psychosis
- manic-depressive psychosis
- dementia praecox
- schizophrenia
- hebephrenic
- catatonic
- paranoid

## NOTES ON TERMINOLOGY

*psychiatrist:* physician who specializes in mental diseases.
*alienist:* old legal term for psychiatrist.
*mental disease:* any illness the chief symptoms of which are abnormal behavior.
*neurosis:* psychoneurosis.
*organic psychosis:* one associated with damage to tissue, as by infection.
*functional psychosis:* one in which no structural damage has been demonstrated.
*trauma:* shock.
*obsession:* persistent recurring thought, *e.g.*, the thought of death.
*compulsion:* uncontrollable impulse to perform some act, *e.g.*, to untie and tie one's shoelaces.
*phobia:* extraordinary fear.

# REFERENCES

## Chapter 2. The Biology of Motives and Emotions

1. Kleitman, N.: 1939. *Sleep and wakefulness.* Chicago: Univ. Chicago Press, pp. 259-269.
2. Morgan, C. T.: 1943. *Physiological psychology.* New York: McGraw-Hill, pp. 391-395.
3. Warden, C. J.: 1931. *Animal motivation.* New York: Columbia Univ. Press, p. 393.
4. Morgan, *op. cit.*, 430-433.
5. *Ibid.*, 451-456.
6. Sherman, M.: 1927. The differentiation of emotional responses in infants. *J. comp. Psychol.*, 7, 265-284 and 335-351.
7. Woodworth, R. S.: 1938. *Experimental psychology.* New York: Holt, pp. 249-252.
8. Glavis, L. R.: 1946. Bombing mission number fifteen. *J. abnorm. soc. Psychol.*, **41**, 189-198.
9. Cannon, W. B.: 1929. *Bodily changes in pain, hunger, fear and rage.* New York: Appleton-Century.
10. Young, P. T.: 1936. *Motivation of behavior.* New York: Wiley, pp. 280-287.
11. Birch, H. G.: 1945. The role of motivational factors in insightful problem-solving. *J. comp. Psychol.*, **38**, 295-317.
12. Goodenough, F. L.: 1931. *Anger in young children.* Minneapolis: Univ. Minn. Press, Chap. 3.
13. Seward, G. H.: 1946. *Sex and the social order.* New York: McGraw-Hill, pp. 171-176.

## Chapter 3. Motivation and Emotion in Social Life

1. Dollard, J., *et al.*: 1939. *Frustration and aggression.* New Haven: Yale Univ. Press, pp. 12-13.
2. Osgood, C. E., Allen, C. N., and Odbert, H. S.: 1939. The separation of appeal and brand-name in testing spot advertising. *J. appl. Psychol.*, **23**, 60-75.

3. *Consumer expenditures in the United States.* National Resources Committee. Washington: Government Printing Office, 1939.
4. Lewin, K. *et al.:* 1944. Level of aspiration. *In* Hunt, J. McV. (ed.), *Personality and the behavior disorders.* New York: Ronald.

## Chapter 4. Sensory Functions

1. Wilska, A.: 1935. Eine Methode zur Bestimmung der Horschwellenamplituden des Trommelfells bei verschiedenen Frequenzen. *Skand. Arch. Physiol.,* 72, 161-165.
2. Galambos, R., and Griffin, D. R.: The sensory basis of obstacle avoidance by flying bats. *J. exp. Zool.,* 1941, **86,** 481-506. Obstacle avoidance by flying bats: the cries of bats. *J. exp. Zool.,* 1942, **89,** 475-490.
3. Hecht, S.: 1944. Energy and vision. *Amer. Scientist,* **32,** 159-177.
4. Hunter, W. S.: 1946. Psychology in the war. *Amer. Psychol.,* **1,** 479-492.
5. Blakeslee, A. F.: 1932. Genetics of sensory thresholds: taste for phenylthiocarbamide. *Proc. nat. Acad. Sci., Wash.,* **18,** 120-130.
6. Steinberg, J. C., and Munson, W. A.: 1936. Deviations in the loudness judgments of 100 people. *J. acoust. Soc. Amer.,* **8,** 71-80.

## Chapter 5. Attention

1. Darrow, C. W.: 1947. Psychological and psychophysiological significance of the electroencephalogram. *Psychol. Rev.,* **54,** 157-168.
2. Poffenberger, A. T.: 1942. *Principles of applied psychology.* New York: Appleton-Century, Chap. 7.
3. *Ibid.*
4. Wechsler, D.: 1944. *The measurement of adult intelligence.* 3d ed. Baltimore: Williams & Wilkins.
5. Brener, L. R.: 1940. An experimental investigation of memory span. *J. exp. Psychol.,* **26,** 467-482.
6. *Ibid.*
7. Henderson, M. T., Crews, A., and Barlow, J.: 1945. A study of the effect of music distraction on reading efficiency. *J. appl. Psychol.,* **29,** 313-317.
8. Poffenberger, *op. cit.,* 141-143.

## Chapter 6. Perception

1. Woodworth, R. S.: 1938. *Experimental psychology.* New York: Holt, pp. 641-643.

2. Sanford, R. N.: 1936. The effects of abstinence from food upon imaginal processes. *J. Psychol.*, 2, 129-136.
3. Levine, R., Chein, I., and Murphy, G.: 1942. The relation of the intensity of a need to the amount of perceptual distortion: a preliminary report. *J. Psychol.*, 13, 283-293.
4. Woodworth, *op. cit.*, 518-534.
5. Woodworth, *op. cit.*, 527-528.
6. Young, P. T.: 1928. Auditory localization with acoustical transposition of the ears. *J. exp. Psychol.*, 11, 399-429.
7. Woodworth, *op. cit.*, 736.
8. Goldstein, K., and Scherer, M.: 1941. Abstract and concrete behavior: an experimental study with special tests. *Psychol. Monogr.*, 53, No. 239, 32-57.
9. Bolles, M. M.: 1937. The basis of pertinence. *Arch. Psychol., N. Y.*, No. 212.

## CHAPTER 7. LEARNING

1. Yerkes, R. M.: 1901. The formation of habits in the turtle. *Pop. Sci. Mon.*, 58, 519-525.
2. Morgan, J. J. B., and Witmer, F. J.: 1939. Treatment of enuresis by the conditioned reaction technique. *J. genet. Psychol.*, 55, 59-65.
3. Cowles, J. T., and Pennincton, L. A.: 1943. An improved conditioning technique for determining auditory acuity of the rat. *J. Psychol.*, 15, 41-47.
4. Hilgard, E. R., and Marquis, D. G.: 1940. *Conditioning and learning.* New York: Appleton-Century, Chap. 13.
5. Shurrager, P. S., and Shurrager, H. C.: 1946. The rate of learning measured at a single synapse. *J. exp. Psychol.*, 36, 347-354.
6. Hilgard and Marquis, *op. cit.*, Chap. 3.
7. Hull, C. L.: 1943. *Principles of behavior.* New York: Appleton-Century.
8. Brownell, W. R.: 1944. Rate, accuracy, and process in learning. *J. educ. Psychol.*, 35, 321-337.
9. Newman, E. B.: 1939. Forgetting of meaningful material during sleep and waking. *Amer. J. Psychol.*, 52, 65-71.
10. Kingsley, H. L.: 1946. *The nature and conditions of learning.* New York: Prentice-Hall, pp. 495-496.
11. Sharp, H. C., Winder, C. L., and Stone, C. P.: 1946. Effects of electroconvulsive shocks on "reasoning" ability in albino rats. *J. Psychol.*, 22, 193-197.
12. Reed, H. B.: 1946. The learning and retention of concepts. *J. exp. Psychol.*, 36, 166-179.

13. Stevenson, B. E.: 1912. *Home book of verse.* 6th ed. New York: Holt. Vol. 1, pp. 1891-1894.
14. Hilgard and Marquis, *op. cit.,* 299-308.
15. Woodrow, H.: 1946. The ability to learn. *Psychol. Rev.,* 53, 147-158.
16. Ray, J. J.: 1936. The generalizing ability of dull, bright and superior children. *Peabody Coll. Contr. Educ.,* No. 175.

## Chapter 8. Thought and Judgment

1. Boring, E. G.: 1946. Mind and mechanism. *Amer. J. Psychol.,* 59, 176.
2. Shaw, W. A.: 1940. The relation of muscular action potentials to imaginal weight lifting. *Arch. Psychol., N. Y.,* No. 247.
3. Bousfield, W. A., and Sedgewick, C. H. W.: 1944. An analysis of sequences of restricted associative responses. *J. gen. Psychol.,* 30, 149-165.
4. Patrick, C. Creative thought in poets. *Arch. Psychol., N. Y.,* 1935, No. 178. Creative thought in artists. *J. Psychol.,* 1937, 4, 35-73. Scientific thought. *J. Psychol.,* 1938, 5, 55-83.
5. Patrick. Creative thought in artists, *op. cit.,* 70.
6. Thornton, G. R.: 1943. The effect upon judgments of personality traits of varying a single factor in a photograph. *J. soc. Psychol.,* 18, 127-148.
7. Luchins, A. S.: 1942. Mechanization in problem solving. *Psychol. Monogr.,* 54, No. 248.
8. Ratner, J. (ed.): 1939. *John Dewey's philosophy.* New York: Modern Lib., p. v.
9. Lantz, B.: 1945. Some dynamic aspects of success and failure. *Psychol. Monogr.,* 59, No. 271.
10. Platt, W., and Baker, R.: 1931. The relation of the scientific hunch to research. *J. chem. Educ.,* 8, 1960-2002.
11. Woodworth, R. S., and Sells, S. B.: 1935. An atmosphere effect in formal syllogistic reasoning. *J. exp. Psychol.,* 18, 451-460.
12. Cantril, H.: 1938. The prediction of social events. *J. abnorm. soc. Psychol.,* 33, 364-389.
13. Glaser, E. M.: 1941. An experiment in the development of critical thinking. *Teach. Coll. Contr. Educ.,* No. 843.
14. Seward, G. H., and Seward, J. P.: 1936. Alcohol and task complexity. *Arch. Psychol., N. Y.,* No. 206.
15. Cattell, R. B.: 1946. *Description and measurement of personality.* Yonkers: World, pp. 425-433.

16. CATTELL, R. B., and MOLTENO, E. V.: 1940. Contributions concerning mental inheritance: II. Temperament. *J. genet. Psychol.*, **57**, 31-47.

### CHAPTER 9. THE INDIVIDUAL AND SOCIETY

1. BENEDICT, R. F.: 1934. Anthropology and the abnormal. *J. gen. Psychol.*, **10**, 59-82.
2. ALEXANDER, F.: 1931. Buddhistic training as an artificial catatonia. *Psychoanal. Rev.*, **18**, 129-145.
3. *Survey of consumer finances: Part II. Consumer incomes and liquid asset holdings. Fed. Res. Bull.* 1947, **33**, 788-802.
4. *Ibid.*
5. DEWHURST, J. F., *et al.*: 1947. *America's needs and resources.* New York: Twentieth Century Fund, Tables 35 and 47.
6. *Fortune*, July, 1938, 37.
7. OSGOOD, C. E., and STAGNER, R.: 1941. Analysis of a prestige frame of reference by a gradient technique. *J. appl. Psychol.*, **25**, 275-290.
8. KORNHAUSER, A. W.: 1939. Analysis of "class" structure of contemporary American society—psychological bases of class divisions. In *Industrial conflict*, Yearb., Soc. psychol. Stud. soc. Issues. New York: Cordon.
9. *Ibid.*, 241.
10. HALL, O. M.: 1934. Attitudes and unemployment. *Arch. Psychol., N. Y.*, No. 165.
11. MURPHY, G., MURPHY, L. B., and NEWCOMB, T. M.: 1937. *Experimental social psychology.* New York: Harper, pp. 946-988.
12. *Ibid.*, 929-932.
13. HEALY, W., and BRONNER, A. F.: 1936. *New light on delinquency and its treatment.* New Haven: Yale Univ. Press.
14. ALLPORT, F. H.: 1932. Psychology in relation to social and political problems. *In* Achilles, P. S. (ed.), *Psychology at work.* New York: Whittlesey.
15. ALLPORT, F. H.: 1934. The J-curve hypothesis of conforming behavior. *J. soc. Psychol.*, **5**, 141-183.
16. SMITH, M. E.: 1926. An investigation of the development of the sentence and the extent of vocabulary in young children. *Univ. Ia. Stud. Child Welf.*, 3, No. 5.
17. SMITH, M. K.: 1941. Measurement of the size of general English vocabulary through the elementary grades and high school. *Genet. Psychol. Monogr.*, **24**, 311-345.

18. Seashore, R. H., and Eckerson, L. D.: 1940. The measurement of individual differences in general English vocabularies. *J. educ. Psychol.*, **31**, 14-38. Hartman, G. W.: 1946. Further evidence on the unexpected large size of recognition vocabularies among college students. *J. educ. Psychol.*, **37**, 436-439.
19. Mosier, C. I.: 1941. A psychometric study of meaning. *J. soc. Psychol.*, **13**, 123-140.
20. Nolte, Karl F.: 1937. Simplification of vocabulary and comprehension in reading. *Elem. Engl. Rev.*, **14**, 119-124, 146.
21. Hunter, W. S.: 1946. Psychology in the war. *Amer. Psychol.*, **1**, 479-492.
22. Rice, S. A.: 1928. *Quantitative methods in politics.* New York: Knopf.
23. Murphy, L. B.: 1937. *Social behavior and child personality.* New York: Columbia Univ. Press.
24. Scott, J. C.: 1930. Systolic blood-pressure fluctuations with sex, anger and fear. *J. comp. Psychol.*, **10**, 97-114.
25. Mead, M. (ed.): 1937. *Cooperation and competition among primitive people.* New York: McGraw-Hill, pp. 460-511.
26. Moore, W. E.: 1946. *Industrial relations and the social order.* New York: Macmillan, pp. 37-38.
27. Klineberg, O.: 1937. *Race differences.* New York: Harper, pp. 112-117.
28. Murphy, G., Murphy, L. B., and Newcomb, T. M.: 1937. *Experimental social psychology.* New York: Harper, p. 532.
29. Davis, J.: 1929. A study of one hundred and sixty-three Communist leaders. *Papers and proc., Amer. sociol. Soc.*, **24**, 42-45.
30. Taussig, F. W., and Joslyn, C. S.: 1932. *American business leaders.* New York: Macmillan.
31. Bavelas, A.: 1942. Morale and the training of leaders. In *Civilian morale*, Yearb., Soc. psychol. Stud. soc. Issues. New York: Reynal & Hitchcock.
32. French, J. R. P., Jr.: 1944. Retraining an autocratic leader. *J. abnorm. soc. Psychol.*, **39**, 224-237.
33. Raslaw, A., Wulfeck, W. H., and Corby, P. G.: 1940. Consumer opinion research: Experimental studies on the form of the questions. *J. appl. Psychol.*, **24**, 334-346.
34. *Press release.* American Institute of Public Opinion. Aug. 9, 1940.
35. *Fortune*, April, 1941, 71.
36. *Publ. Opin. Quart.*, 1946-1947, **10**, 626.
37. *Press release.* American Institute of Public Opinion. May 6, 1942.
38. Link, H. C.: 1946. The Psychological Corporation's index of public opinion. *J. appl. Psychol.*, **30**, 297-309.

39. Cantril, H.: 1944. *Gauging public opinion.* Princeton: Princeton Univ. Press, Chap. 16.

## Chapter 10. Abilities and Tests

1. Wolfle, D.: 1947. Across the secretary's desk. *Amer. Psychol.*, **2**, 26.
2. Terman, L. M., and Merrill, M.: 1937. *Measuring intelligence.* Boston: Houghton Mifflin, p. 46.
3. *Manual of directions for Beta Test, Forms A and B.* Otis Quick-Scoring Mental Ability Tests. Yonkers: World, 1939.
4. Terman and Merrill, *op. cit.*, 12.
5. *Ibid.*, 31.
6. Thorndike, R. L., and Gallup, G. H.: 1944. Verbal intelligence of the American adult. *J. gen. Psychol.*, **30**, 75-85.
7. *Personnel classification tests. Technical manual 12-260.* War Department. 1942. Washington: G.P.O.
8. Wallin, J. E. W.: 1940. The results of multiple Binet retestings of the same subjects: the educational implications of variation of test performance. *J. genet. Psychol.*, **57**, 345-391.
9. Terman and Merrill, *op. cit.*, Chap. 3.
10. Wechsler, D.: 1944. *The measurement of adult intelligence.* 3d ed. Baltimore: Williams & Wilkins.
11. *Manual of instructions.* Chicago Tests of Primary Mental Abilities. Science Research Associates, Chicago, 1943.
12. Garrett, H. E.: 1946. A developmental theory of intelligence. *Amer. Psychol.*, **1**, 372-378.
13. Wechsler, *op. cit.* Compare Tables 41 and 42.
14. Lehman, H. C.: 1936. The creative years in science and literature. *Sci. Mon., N. Y.*, **43**, 151-162.
15. Lehman, H. C.: 1942. The creative years: oil paintings, etchings, and architectural works. *Psychol. Rev.*, **49**, 19-42.
16. Lehman, H. C., and Gamertsfelder, W. S.: 1942. Man's creative years in philosophy. *Psychol. Rev.*, **49**, 319-343.
17. Thorndike and Gallup, *op. cit.*
18. *Manual.* Minnesota Clerical Test. Psychological Corporation, New York, 1946.
19. Bryan, A. I., and Boring, E. G.: 1947. Women in American psychology: factors affecting their professional careers. *Amer. Psychol.*, **2**, 3-20.
20. Thorndike and Gallup, *op. cit.*
21. Johnson, D. M.: Applications of the standard-score IQ to social statistics. *J. soc. Psychol.* (in press).

22. Harrell, T. W., and Harrell, M. S.: 1945. Army [illegible]ral Classification Test scores for civilian occupations. *Educ. psychol. Meas.*, 5, 229-239.

23. Macmeeken, A. M.: 1939. *The intelligence of a representative group of Scottish children.* Bickley, Kent, England: Univ. London Press.

24. Havighurst, R. J., Gunther, M. K., and Pratt, I. E.: 1946. Environment and the Draw-A-Man Test: the performance of Indian children. *J. abnorm. soc. Psychol.*, 41, 50-63.

25. Rohrer, J.: 1942. The test intelligence of Osage Indians. *J. soc. Psychol.*, 16, 99-105.

26. Klineberg, O.: 1935. *Race differences.* New York: Harper, Chap. 9.

27. Newman, H. H., Freeman, F. N., and Holzinger, K. J.: 1937. *Twins: a study of heredity and environment.* Chicago: Univ. Chicago Press.

28. Woodworth, R. S.: 1941. Heredity and environment. *Soc. Sci. res. Counc. Bull.* 47.

29. Thomson, G.: 1918. The trend of national intelligence. *Eugen. Rev.*, 38, 9-18.

30. *Ibid.*

31. Finch, F.: 1946. Enrollment increases and changes in the mental level of the high-school population. *Appl. Psychol. Monogr.*, No. 10.

32. Terman, L. M. (ed.): 1926. *Genetic studies of genius.* Vol. 2: *The early mental traits of three hundred geniuses.* Stanford University: Stanford Univ. Press.

33. *Ibid.*, 698.

34. Terman, L. M. (ed.): 1930. *Genetic studies of genius.* Vol. 3: *The promise of youth.* Stanford University: Stanford Univ. Press.

35. Terman, L. M.: 1942. The vocational successes of intellectually gifted individuals. *Occupations*, 20, 493-498.

36. Terman, L. M.: 1940. Psychological approaches to the biography of genius. *Science*, 92, 293-301.

37. *Ibid.*, 300.

38. *Ibid.*, 299.

39. Shuman, J. T.: 1945. The value of aptitude tests for factory workers in the aircraft engine and propeller industries. *J. appl. Psychol.*, 29, 156-160.

40. Flanagan, J. C.: 1946. The experimental evaluation of a selection procedure. *Educ. psychol. Meas.*, 6, 445-466.

41. Vernon, P. E.: 1947. Research on personnel selection in the Royal Navy and the British Army. *Amer. Psychol.*, 2, 35-51.

42. Geldard, F. A., and Harris, C. W.: 1946. Selection and classification of aircrews by the Japanese. *Amer. Psychol.*, 1, 205-217.